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Department of Energy

Richland Operations Office
P.O. Box 550
Richland, Washington 99352

9003762

SEP 07 1990

90-ERB-095

Mr. Paul T. Day
Hanford Project Manager
U. S. Environmental Protection Agency
Region 10
712 Swift Boulevard, Suite 5
Richland, Washington 99352

Dear Mr. Day:

DISPOSITION OF COMMENTS ON THE 100-KR-4 OPERABLE UNIT WORK PLAN

Attached are the dispositions of comments on the 100-KR-4 Operable Unit Work Plan. Because of the relatively short time available to incorporate comments, we would like to resolve these dispositions at the earliest possible date. We recommend that it be done by telephone sometime during the week of September 10, 1990.

If you have any questions, please call Mr. K. M. Thompson at (509) 376-6421.

Sincerely,

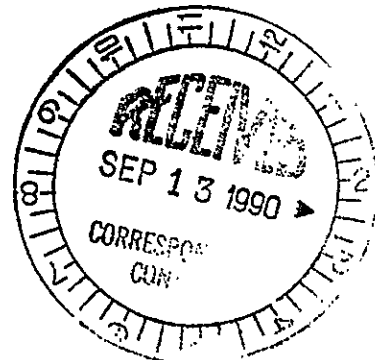
Steven H. Wisness
Hanford Project Manager

ERD:KMT

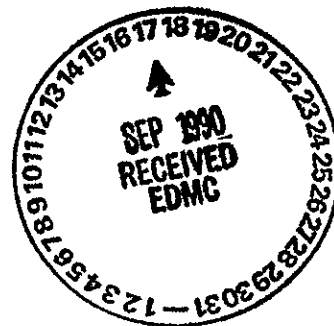
Attachment

cc w/att:
T. L. Nord, Ecology

cc w/o att:
R. E. Lerch, WHC
T. B. Veneziano, WHC



CORRESPONDENCE



START

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TECHNICAL REVIEW COMMENTS
REMEDIAL INVESTIGATION/FEASIBILITY STUDY WORK PLAN
100-KR-4 OPERABLE UNIT

Cover letter comment #1: Accept.

Cover letter comment #2: Accept. The assumption stated in the second paragraph of Section 5.2.4 (that no residual river sediment contamination exists) is misleading. Direct evidence either for or against the presence of residual contamination in Columbia River sediment apparently is sparse. Since one of the objectives of a remedial investigation is to define the extent of contamination from former operations, it is highly relevant to investigate the subsurface outfall points in the river, and the depositional regime in which the outfall is located.

Section 5.2.4 will be revised as follows:

- a) The underlying assumption associated with Task 4 will be restated to reflect the paucity of direct evidence regarding residual contamination from 100-K reactor operations. The data deficiency relates to shoreline and river bed sediment; groundwater seepage at the river banks and river bed; and "background" water chemistry and radiological characteristics of river water above the 100-K Area shoreline.
- b) The descriptions of subtasks will be revised to emphasize sediment and water sampling activities designed to reduce the data deficiency.
- c) Inconsistencies between statements in Section 3.1.4.4 "Sediment Contamination" and Section 5.2.4 "Task 4 -- Surface Water and Sediment Investigation" will be removed.
- d) Attachment 1, the "Field Sampling Plan," will be revised as necessary to reflect changes made in Section 5.2.4.

Work Plan:

1-1 Deficiency: Section 1.1, p. WP 1-5

The first paragraph of this section contains the acronym "WHC." WHC has not yet been defined in the text and does not appear in the acronym list.

Recommendation:

Define the acronym "WHC."

Response:

The acronym referred to appears as a reference citation. Will include it in the acronym list.

1-2 Deficiency/Recommendation: Section 1.2, p. WP 1-9

The title for Figure 1-3 misspells process.

Response:

All extra copies of the work plan looked at have the word spelled correctly.

1-3 Deficiency/Recommendation: Section 1.4, p. WP 1-13

The reference "DOE-RL 1983" is not listed in "Section 8.0 REFERENCES."

Response:

Will include this reference.

2-1 Deficiency: Section 2.1.1, p. WP 2-1, first paragraph

The last two lines state, "The 100-KR-4 operable unit encompasses all of the 100-K Area and vicinity, including portions of the Columbia River between River Miles 380 and 382 (Figure 2-1)." The River Miles 380 and 382 are not shown on Figure 2-1.

Recommendation:

River Miles 380 and 382 for the 100-KR-4 operable unit should be marked on Figure 2-1. Also give the datum for "River Miles."

Response:

Will delete this statement as it adds nothing and seems to be a point of confusion.

2-2 Deficiency: Section 2.1.3, Table 2-1, p. WP 2-4

In Table 2-1, the following events are stated:

1974: 105-KE basin leak detected
1975: N reactor irradiated fuel storage begins in 105-KE
1980: 105-KE basin leak isolated and repaired

Was the leak rectified before storing fuel in 1975? If not, did the leak continue until it was isolated and repaired in 1980?

Recommendation:

Incorporate this information into the table.

Response:

Information will be added to the table.

2-3 Deficiency: Table 2-2, p. WP 2-7

The reference for this table is given as AEC-GE, 1964. However, the data reported in Table 2-2 is for 1955 to present.

Recommendation:

Include all references used to prepare this table.

Response:

Will include other reference(s) used to prepare this table.

2-4 Deficiency: Table 2-2, p. WP 2-7

In this table, the facility outfall structure (1908-K) is shown as active and the facility purpose is said to be to "control effluent discharge from 107-KE and 107-KW retention basins." Retention basins are currently inactive (dry). What is the current function of outfall structure?

Recommendation:

Explain the purpose of the outfall structure.

Response:

Accept.

2-5 Deficiency: Table 2-2, p. WP 2-7

The radioiodine monitoring building is shown to be monitoring the radioactivity of effluent, and was discontinued in 1971. There are no reported data and no discussion of results in this work plan.

Recommendation:

Provide the data on effluent radioactivity monitoring and discuss the results in Section 3.0.

Response:

Nothing that constitutes data has been found to date. Will provide a brief discussion of the function of this building.

2-6 Deficiency/Recommendation: Table 2-2, p. WP 2-8

"118-K-1" should be substituted for "100-K Burial ground" under the facility designation in this table.

Response:

Accept.

2-7 Deficiency: Table 2-2, p. WP 2-10

The facility 1608 KE/KW wastewater pump houses are shown to collect and pump potentially contaminated liquids from the 105 reactor buildings and pump effluent to the reactor effluent line. No data is presented on the number of pumps, capacity, frequency of use, and the characteristics of effluent handled.

Recommendation:

Provide more information on the contaminated wastewater from the reactor buildings.

Response:

The 1608 KE and KW facilities did not exist in the K-Area and will be deleted from the plan.

2-8 Deficiency: Table 2-2, p. WP 2-10

The 1706-KE and 1706-KER facilities are reported as active facilities for testing.

Recommendation:

Explain in detail the purpose of the 1706-KE and 1706-KER facilities.

Response:

Accept.

2-9 Deficiency: Table 2-2 and Figure 2-2, p. WP2-10 and WP 2-5

Cannot find 1608-KE/KW on Figure 2-2.

Recommendation:

Add to figure.

Response:

See response to comment 2-7.

2-10 Deficiency: Table 2-2 and Figure 2-2, p. WP 2-10 and WP 2-5

Facilities on map, but not in table;

- Filter crib near 1904-K

- Burial ground near 107-KE-A (is this the 118-K-2 Burial Ground? - see p. WP 2-20)
- Thimble Caves (KE + KW)
- Experimental radiation exposure (KE)
- 100-K Burning Pit

Recommendation:

Include descriptions of facilities in table.

Response:

This information is included in Table 3-1.

2-11 Deficiency: Table 2-2, p. WP 2-12

No details are provided for the Acid Tanks, sodium Dichromate Tanks, Borrow Pit, Burning Pit, Burial Ground, and Filter Crib.

Recommendation:

Provide details for these facilities.

Response:

This information is included in Table 3-1.

2-12 Deficiency: Section 2.1.3, p. WP 2-13, top paragraph

The text refers to two numbering systems. Will both be used or only one?

Recommendation:

Specify which system will be used. Also, consider developing a table to cross-reference the two systems if both will be used.

Response:

Only WIDS system will be used when applicable.

2-13 Deficiency: Section 2.1.4.1, p. WP 2-18, third paragraph

This paragraph discusses frequent fuel-cladding failures and the contamination of cooling water effluent. No data is provided on the number of times fuel-cladding ruptures occurred, the effluent characteristics, and the quantity of effluent disposed of during fuel-cladding failure periods.

Recommendation:

Provide information on the number of times fuel-cladding failed; the

years in which these failures happened; whether failures occurred at one reactor or more reactors at a time; the quantity and concentration of effluent disposed; whether effluent was monitored for radioactivity levels; whether the reactor facilities were decontaminated after fuel-cladding failure; whether there was any incidence of radiation exposure during fuel-cladding failure, either within the reactor buildings or outside the disposal facilities. These items should be either discussed here or incorporated in the investigation task for data compilation.

Response:

This will be part of the data compilation task.

2-14 **Deficiency:** Section 2.1.4.2, p. WP 2-19, fourth paragraph

The text discusses in general the leaks from the 107-KE and 107-KW retention basins, but does not identify the retention basin from which the leak had occurred -- was the leak from bottom or joints or holes on the walls or due to foundation failure? Was the leak visible from the outside? When was the leak found and repaired? Was there any overflow from trench to crib during such times? Was the leaking effluent clear or did it contain suspended solids?

Recommendation:

Answer the above questions or include them in the investigation task for data compilation.

Response:

This will be part of the data compilation task.

2-15 **Deficiency:** Section 2.1.4.3, p. WP 2-19

This section discusses miscellaneous waste disposal in small cribs and drains as well as in the 116-K-2 trench. The "small cribs and drains" are not included in Table 2-2.

Recommendation:

Include the "small cribs and drains" in Table 2-2, with a description of each facility, its purpose, and dimensions.

Response:

This information is included in Table 3-1.

2-16 **Deficiency:** Section 2.1.4.3, and Figures 2-2 and 2-3, p. WP 2-19, WP 2-5 and WP 2-15

Cannot find cribs 116-KE-1 or 116-KW-1, or french drains 116-KW-2 or

116-KE-3 on the figures or in Table 2-2

Recommendation:

Include on figures and in Table 2-2.

Response:

These details are shown elsewhere; see Figure 3-1, Table 3-1 and section 3.1.1.2.

2-17 Deficiency: Section 2.1.4.4, p. WP 2-20

This section describes the sources for radioactive sludge and radioactive solid waste. The information provided is not sufficient.

Recommendation:

Provide more information on the frequency, quantity, and characteristics of sludge removed and disposed from each facility. Also, provide information on the disposal facilities, such as the solid waste burial ground. Describe the area occupied by the solid waste burial ground. Is the disposal facility an excavated pit? Are there separate disposal areas for liquid waste, sludge, and non-radioactive solid wastes?

Response:

Reliable data sources have not been found and will be part of the data compilation phase.

2-18 Deficiency/Recommendation: Section 2.1.4.8, p. WP 2-22, top paragraph

The text states, "ground sterilants were used for both ground and aerial application." Specify the kind of sterilants used. Describe the quantity and frequency of application.

Response:

Records are poor concerning use of ground sterilants and will be investigated further prior to the RI.

2-19 Deficiency: Section 2.1.5, p. 2-22, first paragraph

This paragraph states that the success of past decontamination and deactivation efforts will not be assessed as part of the work plan, but as part of the remedial investigation. These statements are contradictory. The assessment of potential sources of ground-water contamination should include all decontaminated and deactivated facilities where contaminants could migrate.

Recommendation:

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The task of evaluating past decontamination and deactivation efforts should be included in the 100-KR-1, 2, and 3 work plans; these work plans should be referenced in the 100-KR-4 work plan.

Response:

Accept. However, the KR-2 and KR-3 work plans will be written at a later date.

2-20 Deficiency/Recommendation: Section 2.1.5, p. WP 2-22, second paragraph

In the second sentence, the text states, "The success of past decontamination and deactivation efforts using current standards and future contaminant potential has not been addressed in this work plan." The meaning is unclear and should be clarified.

Response:

Accept.

2-21 Deficiency: Section 2.1.5, p. WP 2-22

Is 116-K-2 Trench backfilled or does it still receive water from 2-inch line? (Also see p. WP 3-14)

Recommendation:

Make clearer statement about present nature of 116-K-2 Trench.

Response:

Accept. The trench was backfilled.

2-22 Deficiency/Recommendation: Section 2.1.6, p. WP 2-23, first paragraph

In the fifth line, substitute "116-K-1 Trench" for "116-K-2 Crib."

Response:

Accept.

2-23 Deficiency: Section 2.2.2.1.1, p. WP 2-24, bottom of page

The text refers to the Ellensburg Formation, which interbeds with the Columbia River Basalt Group. This is not shown in Figure 2-4 (p. 2-25).

Recommendation:

Show the relationship between the Ellensburg Formation and the

Columbia River Basalt Group in Figure 2-4.

Response:

Accept.

2-24 Deficiency/Recommendation: Section 2.2.2.1.2, p. WP 2-27

In the fifth line, the text states, "The Columbia River Basalt Group is subdivided into five formations." The five formations should be listed.

Response:

Accept.

2-25 Deficiency: Section 2.2.2.1.3, p. WP 2-27 and WP 2-28

Figure 2-6, shows the Section Type I of the Ringold Formation in the 100-K Area. However, in the second paragraph of Section 2.2.2.1.3, the next to last sentence states, "The Section Type I is not thought to be present beneath the 100-K Area."

Recommendation:

Clarify the above statement.

Response:

Accept.

2-26 Deficiency/Recommendation: Section 2.2.2.1.6, p. WP 2-30

The reference at the end of the sixth line (Fecht 1978, p. 17) should be listed in "8.0 REFERENCES."

Response:

Accept.

2-27 Deficiency: Section 2.2.2.2, p. WP 2-30

In this section as well as in other sections, the text mentions the "600 Area." This area is not shown either in the Site Map or in Plate 1.

Recommendation:

Include the "600 Area" on Figure 1-1.

Response:

Accept. Will explain "600 Area" in text.

2-28 **Deficiency:** Figure 2-10 and Table 2-3, p. WP 2-35 and WP 2-39

Well 6-77-54 is on the figure, but not in the table.

Recommendation:

If so, correct on the figure and include in the table.

Response:

Accept. Will check locations, numbers, etc. of all wells and correct figure or table as appropriate. Some survey data appear to be in error, however. We will use the best currently available data and the wells will be surveyed in Phase I.

2-29 **Deficiency:** Figure 2-10 and Table 2-3, p. WP 2-35 and WP 2-39

Is well K71-52 supposed to be 6-71-52?

Recommendation:

If so, correct on the figure and include in table.

Response:

Accept. Will check locations, numbers, etc. of all wells and correct figure or table as appropriate. Some survey data appear to be in error, however. We will use the best currently available data and the wells will be surveyed in Phase I.

2-30 **Deficiency:** Figure 2-10, p. WP 2-35

Should well 6-77-71 be 6-71-77? Are the locations reversed for this well and well 6-72-73?

Recommendation:

Check locations and numbers and correct on the figure.

Response:

Accept. Will check locations, numbers, etc. of all wells and correct figure or table as appropriate. Some survey data appear to be in error, however. We will use the best currently available data and the wells will be surveyed in Phase I.

2-31 **Deficiency:** Figure 2-10 and Table 2-3, p. WP 2-35 and WP 2-39

It appears that either the location or the elevation of well K16 may be wrong. From examination of the topo sheet for the area, it appears

that this well is ~60 feet below grade.

Recommendation:

Check location and elevation data.

Response:

Accept. Will check locations, numbers, etc. of all wells and correct figure or table as appropriate. Some survey data appear to be in error, however. We will use the best currently available data and the wells will be surveyed in Phase I.

2-32 Deficiency: Figure 2-10 and Table 2-3, p. WP 2-35 and WP 2-39

It appears that either the location or the elevation of well K24 may be wrong. From examination of the topo sheet for the area, it appears that the elevation in the table is about 25-30 feet too high.

Recommendation:

Check location and elevation data.

Response:

Accept. Will check locations, numbers, etc. of all wells and correct figure or table as appropriate. Some survey data appear to be in error, however. We will use the best currently available data and the wells will be surveyed in Phase I.

2-33 Deficiency: Table 2-3, p. WP 2-39

Well records have not been cross-checked with USGS well files. Natural-gamma logs are on file for wells K-1, 7, 11, 12, 13, 14, and 16. These logs were made in 1952 and represent pre-operating conditions.

Recommendation:

Make note these data exist and will be examined to determined validity and usefulness. It may be that these logs will prove to be of insufficient quality or have inadequate documentation, but their potential needs to be investigated.

Response:

Accept. Will look into additional well information in the groundwater investigation.

2-34 Deficiency: Table 2-3, p. WP 2-39

The accuracy of the casing elevations, and their relationship to land

surface, are not indicated. Does a value with .00 indicate a site that has not been surveyed?

Recommendation:

Indicate assumed accuracy of elevation data.

Response:

Accept. Will discuss survey accuracy and explain notation.

2-35 Deficiency: Table 2-3, p. WP 2-39

No accuracy indicated regarding site locations. Does a coordinate ending in .00 indicate an estimated location?

Recommendation:

Indicate assumed accuracy of well locations.

Response:

Accept. Will discuss survey accuracy and explain notation.

2-36 Deficiency: Table 2-3, p. WP 2-39

There are inconsistencies between well depths and screened intervals. Wells K-20, 21, 22, 23, and 6-81-62 have depths less than screened intervals.

Recommendation:

Indicate that well depth is given; original depth drilled, and most recent measured depth? Perhaps several depths should be given and defined; "depth drilled", "completed depth", and/or "measured depth".

Response:

Accept. Will check values and correct or explain apparent anomalies.

2-37 Deficiency: Table 2-3, p. WP 2-40

The table mentions "Sources," but lists no sources. Few of the abbreviations in the table, such as P-Sub, P-submrsbl, and T.D, are defined.

Recommendation:

Provide the sources for the data and define all abbreviations.

Response:

Accept.

2-38 **Deficiency:** Figure 2-12, p. WP 2-42

The unit for the depth scale "Depth Below Land Surface" is not given. The title is incorrect. One reference has an incorrect year.

Recommendation:

Specify feet as the unit for the "depth below land surface." For the figure title, substitute "Geologic Logs" for "Graphic Logs," and under "SOURCES," substitute "Fecht et al. 1985" for "Fecht et al. 1984."

Response:

Accept.

2-39 **Deficiency:** Figure 2-12, p. WP 2-42

Source of B3-2 log is given as McGhan et al. 1985; there are no logs in that reference.

Recommendation:

Give correct reference.

Response:

Accept. Will give correct reference.

2-40 **Deficiency:** Section 2.2.2.2.1.2, p. WP 2-49

Well 199-B3-2 (1-B3-2) is discussed on this page and elsewhere. However, the well (1-B3-2) location is not shown on the well location maps (Figures 2-10 and 2-11 or elsewhere).

Recommendation:

Indicate the well location (1-B3-2) on the appropriate maps.

Response:

Accept. Location will be shown on map.

2-41 **Deficiency:** Section 2.2.2.2.1.2, p. WP 2-49

Informal subdivision of Ringold Formation using terms "upper", "middle", and "lower" is easily confused with Ringold classification scheme commonly in use.

Recommendation:

Devise other terminology; e.g., "upper part of the undifferentiated Ringold".

Response:

Accept. Will change nomenclature for geologic units in Ringold and will relate them to hydrostratigraphic units.

2-42 Deficiency: Section 2.2.2.2.1.2, p. WP 2-50

In the first line from the top, the year for the reference "Brown 1962" is given as 1962. Under the list of references, "8.0 REFERENCES," the year is shown as 1989.

Recommendation:

Correct this error.

Response:

Accept.

2-43 Deficiency: Section 2.2.2.2.1.2 and Figure 2-15, p. WP 2-50 and WP-51

At this point, identifications of Ringold top are probably not good enough, especially with doubts regarding land surface elevations of some wells, to warrant the detailed contours.

Recommendation:

Redraw map with more generalized contours reflecting the present uncertainty.

Response:

Accept. Will re-examine data and revise figure and text accordingly.

2-44 Deficiency: Section 2.2.2.2.1.2 and Figure 2-15, p. WP 2-50 and WP 2-51

The well log summaries in the Hanford groundwater data base, which include lithologic descriptions and geologic unit identifications, do not match the unit picks in this work plan for many of the wells. Presumably the picks made for this work plan were made from the more complete original driller's reports. However, the lack of agreement may indicate that the identification of the unit contacts is open to considerable interpretation. Also, the Hanford groundwater data base log summaries do not indicate the same distribution of "cemented" Ringold zones as described in the work plan.

Recommendation:

Redraw the map with more generalized contours reflecting the present uncertainty.

Response:

Accept. Will re-examine data and revise figure and text accordingly.

2-45 Deficiency: Figure 2-15, p. WP 2-51

In this figure, the unit for "ELEV" is not given in the tabular column. The reference years 1962 and 1984 under "SOURCE" are incorrect.

Recommendation:

Specify "ft, msl" as the unit for "ELEV." Give the correct reference years under "SOURCE."

Response:

Accept. Will re-examine data and revise figure and text accordingly.

2-46 Deficiency: Figure 2-15, p. WP 2-51

Wells K-14, 17, and 26 are in the table, but not on the map. If wells cannot be plotted, their data on the Ringold top is irrelevant. Also, if their locations are in doubt, what accuracy can be placed on the top of the Ringold elevations?

Recommendation:

Remove values from the table.

Response:

Accept. Will re-examine data and revise figure and text accordingly.

2-47 Deficiency:

Wells K-16 and 20 are on the map, but not in the table.

Recommendation:

Either add values to the table or remove them from the figure.

Response:

Accept. Will re-examine data and revise figure and text accordingly.

2-48 Deficiency: Figure 2-15, p. WP 2-51

Contours violate data for K-11.

Recommendation:

Either recontour or explain why K-11 value is ignored.

Response:

Accept. Will re-examine data and revise figure and text accordingly.

2-49 Deficiency: Figure 2-15 and Section 8.0, p. WP 2-51 and WP 8-1

References listed (Brown 1962 and Fecht et al. 1984) are not in the reference list.

Recommendation:

Include the references.

Response:

Accept. Will re-examine data and revise figure and text accordingly.

2-50 Deficiency: Figure 2-15, p. WP-2-51

It appears that the drawing of the contours was influenced by factors other than data points shown (e.g., 420-foot contour on east side of the figure changes through 180 degrees with no data points apparent).

Recommendation:

Either redraw the contours to reflect only data points given, or indicate source(s) of other data.

Response:

Accept. Will re-examine data and revise figure and text accordingly.

2-51 Deficiency: Figure 2-15, p. WP 2-51

Top of Ringold is not interpreted far enough to the south. Another interpretation of the available logs for wells 6-70-68 and 6-66-64 indicates that the Ringold is not reached in either well (bottom elevations of 377 and 394 feet, respectively). If so, the Ringold surface may dip to the south from the 100-K Area as well as to the north.

Recommendation:

Use additional wells around the area to increase the extent of the contours in the figure.

Response:

Accept. Will re-examine data and revise figure and text accordingly.

2-52 Deficiency: Figure 2-15, p. WP 2-51

The assumed accuracy of the land surface elevations of the wells is not indicated. Some of the relief seen in the contours may reflect inaccuracies in land surface elevations.

Recommendation:

Indicate estimated range of Ringold top for each well based on assumed accuracy of land surface data.

Response:

Accept. Will re-examine data and revise figure and text accordingly.

2-53 Deficiency/Recommendation: Section 2.2.2.2.1.4, p. WP-53, second paragraph

In the fifth line the word "pond" is used for "crib" in "the 116-K-1 pond berm." Use the word "crib" for 116-K-1, for consistency throughout the work plan.

The tenth line contains the acronym "USAEC." USAEC has not yet been defined in the text and does not appear in the list of acronyms. Define the acronym "USAEC."

Response:

Accept.

2-54 Deficiency: Section 2.2.3.1, p. WP 2-54

In line four, the text states, "Therefore, in a general regional sense, vertical ground water movement is upward in response to increasing hydraulic head with depth." The statement is unclear.

Recommendation:

Clarify the above statement using regional hydrogeological data.

Response:

Accept.

2-55 Deficiency: Table 2-5, p. WP 2-57

For what time period/river flow conditions do descriptions of seeps pertain? Most (all?) of these seeps represent bank storage and therefore the quality and quantity of the discharges are very much dependent on the recent river-stage history.

Recommendation:

Indicate the prior river-stage conditions.

Response:

Accept. Will include this information if it is in the reference.

2-56 Deficiency: Section 2.2.3.2.2.2, p. WP 2-60

The likely effect of "cemented" layers on the flow system is difficult to predict. Although the materials in these layers may have relatively low primary permeability, they may have significant secondary permeability (primarily vertical) related to fracturing. Relatively thin cemented zones may have numerous vertical fractures; these fractures are often very difficult to see in well bores (being vertically oriented).

Response:

Accept. The hydrologic properties of the subsurface (including the cemented zones) will be investigated as part of Phase I of the Remedial Investigation. The description of hydrostratigraphic units in this work plan will be revised to reflect more uncertainty about the continuity of the cemented zones.

2-57 Deficiency: Section 2.2.3.2.2.2, p. WP 2-61, top paragraph

The text states, "Also, the continuity of these layers (or the degree of cementing) may change resulting in variations to ground water and contaminant flow." There is no discussion or any reference to indicate that the degree of cementing may change due to ground water and contaminant flow. Also, the term, "contaminant flow" was introduced abruptly in this sentence. In general, the degree of cementing may change due to the presence of silicious, calcarious, and other materials present in ground water or in the soil layers.

Recommendation:

Provide evidence that the degree of cementing may change due to variations in groundwater and contaminant flow.

Response:

Accept. The text states that the continuity and degree of cementation may affect groundwater flow and contaminant transport, not the other way around. The text will be revised to clarify this.

2-58 Deficiency: Section 2.2.3.2.2.2, p. WP 2-61, third paragraph

The third paragraph of this section discusses the potential effect of

the cemented gravel layers on contaminant movement; cation exchange capacities (CEC) are discussed using the CEC data in Table 2-7. The potential effect of the cemented gravel layers on contaminant movement is said to be evident in the variations in cation exchange capacities. According to Table 2-7, cemented gravel layers exist only under well 699-78-62, which is far away from the 100-KR-1 Area. The CEC data for the geologic layers underlying 100-KR-1 (Wells K-19, K-25, K-26, and K-18) are very low, indicating increased contaminant mobility.

Significant increases in CEC values, which could indicate decreased contaminant mobility, are said to correspond to layers in which caliche or clay were noted. Significant increase in CEC values were seen in layers below 100 feet (30 m) from ground surface. These layers contained mostly sand and clay, with some gravel and caliche. In the 100-KR-1 Area, the geologic layers are mostly sand, gravel, and boulders, with very low CEC values. The cemented gravel layers are reported only for well 699-78-62, which is far east of the 100-KR-4 operable unit (Table 2-7).

Given the hydrogeology of the site, lithology data for well 699-78-62 and ground water flow during reactor operations period (Figure 2-19 from 1967 data), contaminants might have migrated towards well 699-78-62. However, more data on the hydrogeology and lithology of the site for 100-KR-1 Area is necessary to confirm the effect of the cemented gravel layers on contaminant movement.

Recommendation:

Discuss the potential effect of cemented gravels on contaminant movement by comparing the data for lithology of wells as well as the contaminants present in the soil and ground water.

Response:

The effect of cemented gravels on contaminant transport will be evaluated in Phase I of the Remedial Investigation. The text will be revised to discuss other wells with cemented gravels and reference to Table 2-7 will mention that other wells exist but they do not have CEC data.

2-59 Deficiency/Recommendation: Table 2-7, p. WP 2-65

The reference "Bensen et al 1963" under "Sources" at the bottom of the table should be listed in "8.0 REFERENCES."

Response:

Accept.

2-60 Deficiency: Figure 2-17, p. WP 2-69

Water level for well K-13 was measured in 3/15/87. This should not be

included in a 1989 Water Table map.

Recommendation: Remove this data point from the figure.

Response:

Accept. Will reconstruct the figure properly.

2-61 Deficiency: Figure 2-17, p. WP 2-69

Map shows "influence" of wells not included in the table (e.g., flexure of contour around K-3).

Recommendation:

Either include missing values, or redraw contours to reflect only the water levels in the list.

Response:

Accept. Will reconstruct the figure properly.

2-62 Deficiency/Recommendation: Figures 2-17, p. WP 2-69 and Figure 2-19, p. WP 2-75

Specify "ft, msl" as the unit for elevation in the tabular column. Cite the reference for the 1967 data used.

Response:

Accept. Will reconstruct the figure properly.

2-63 Deficiency: Figure 2-17, p. WP 2-69

Is it correct to assume that the casing elevations for wells K-13, 27, 28, 29, and 30 are in doubt (see comment on Table 2-3, p. WP 2-39)? If so, the detail shown in drawing the 395-foot contour may not be warranted.

Recommendation:

If elevations are in doubt, so indicate.

Response:

Accept. Will reconstruct the figure properly.

2-64 Deficiency: Figure 2-17, p. WP 2-69

The "NOTE" indicates that dates closest to 6/19/67 were selected for this map. Should it read 6/09/89? Why not use date closest to 2/14/89, where greatest concentration of data appears.

Recommendation:

Correct note.

Response:

Accept. Will reconstruct the figure properly.

2-65 Deficiency: Figure 2-17, p. WP 2-69

The different dates of water levels used to construct the map may invalidate the interpretation. The stage of the Columbia River (based on records at the station below Priest Rapids Dam) differs by at least 5 feet for the dates used.

Recommendation:

Redraw the map using a narrower time period (checked against the river stage record) or at least state the possible inaccuracy in the interpretation.

Response:

Accept. Will reconstruct the figure properly.

2-66 Deficiency: Figure 2-17 and Section 2.2.1, p. WP 2-69 and WP 2-24

Map conflicts with average river stage given earlier (395 feet).

Recommendation:

Resolve conflict (is average stage wrong, does map represent the flow system at low stage, do contours need to reflect inflow from the river?).

Response:

The water table map (which is being reconstructed; see 2-60 to 2-65) was drawn from water levels measured in the wells in and around the K-Area. No river stage data was available at that time, so the river stage could not be considered in constructing the map.

2-67 Deficiency: Section 2.2.3.2.3, p. WP 2-71

Raymond and Brown (1963) estimated inland extent of water-table fluctuation due to river-stage effect of approximately 1-2 miles. They estimated inland limit of river water movement to be <0.1 to as much as 0.5 miles. Was this reference consulted in writing the work plan?

Recommendation:

This reference should be consulted and cited.

Response:

Raymond and Brown (1963) was consulted; however, the study focused on wells in the 300 Area, which is hydrologically and geologically quite different from the 100 Areas. River stage fluctuations during the period of study was approximately 22 ft, much greater than fluctuations observed now. The 100-H Area provides a better analog to the 100-K Area.

2-68 **Deficiency:** Section 2.2.3.2.4.1, p. WP 2-71

Discussion of groundwater discharge to river is confusing. Shallow groundwater discharges (at least during some river stage conditions), as indicated, directly to the river. If the river is the major discharge area, then the deeper groundwater flow most likely would occur vertically to the river, not "...does not interact directly with ground water..." in the deeper part of the section may be misleading. River-stage changes probably propagate into the deeper part of the section, and water moves between the river and the deeper part of the section (vertically through the shallower part).

Recommendation:

Rewrite this section.

Response:

Accept. Rewrite section to clarify.

2-69 **Deficiency:** Section 2.2.3.2.5, p. WP 2-73, first paragraph

The last two sentences state, "Once production ceased, the groundwater elevations reverted to "natural" conditions. Contaminants which had been transported to the south could then migrate back toward the site and the river, perhaps at greater depth." No substantial evidence is given for this statement.

Recommendation:

During reactor operation, there was sufficient hydraulic head from the groundwater mound (25 ft) to transport contaminants. However, once the operations of the reactors ceased, the hydraulic head dropped from 5 feet to 10 feet, depending upon the ground-water level fluctuations. This may not be sufficient to revert the migration of contaminants back to the site and the river. According to the groundwater elevations shown in Figure 2-17, there is no substantial head available for contaminant migration towards the site at a faster rate than during operations. Data is needed to substantiate the statement cited above. Contaminant migration depends on the soil conditions, groundwater flow rate, and the type of contaminants present.

Response:

Accept. Rewrite section to clarify.

2-70 Deficiency: Figure 2-19 and Table 2-8, p. WP 2-75 and WP 2-79

Figure uses water levels from 6/67, 9/67, and 10/67; well K-11 shows a difference of 5 feet in water level from 6/67 to 10/67 (Table 2-8). Changes in recharge and/or changes in river stage may have been too great to allow using water levels taken four months apart.

Recommendation:

Redo figure with water levels from shorter time period or retain figure, but explain possible misinterpretation due to long period of water levels used.

Response:

Accept. A new water table map will be redrawn using data from October 12 and 19, 1967.

2-71 Deficiency/Recommendation: Table 2-9, p. WP 2-91

Three references at the bottom of this page -- "Hitchcock and Crunquist 1978," "Department of Natural Resources 1987," and "Department of Wildlife" should be listed under "8.0 REFERENCES."

Response:

Accept. Two are listed under "Washington Department of..."

2-72 Deficiency/Recommendation: Section 2.2.6.6, p. WP 2-97, second paragraph

Include the references for the documents "WAC 173-201- 080(2)" and "WAC 173-201-045(2)b" in the list of references.

Response:

This is listed under the State Regulations section as the reference to the Chapter.

2-73 Deficiency: Section 2.2.7.4, p. WP 2-99

The text refers to the Community Relations Plan without directing the reader to Attachment 5.

Recommendation:

Insert "see Attachment 5" after the last word in the paragraph.

Response:

Accept.

3-1 Deficiency: Section 3.1, p. WP 3-1, first paragraph

The last sentence states, "A goal of this remedial investigation will be to develop data on the distribution and concentration of nonradioactive inorganic and organic species." This remedial investigation is intended not only to develop data on the distribution and concentration of nonradioactive inorganic and organic species but also to develop more data on the distribution and concentration of radioactive species.

Recommendation:

Include "radioactive species" in the text.

Response:

Accept.

3-2 Deficiency/Recommendation: Table 3-1, p. WP 3-5

References should be provided for the information in this table.

Response:

Accept.

3-3 Deficiency: Table 3-1, p. WP 3-5

In Column Five, the text describes, "Effluent from 107-KE and 107-KW retention basins at times of high activity due to fuel element failure" for 116-K-1 and 116-K-2 facilities. However, during fuel element failure, the effluent was directly discharged to the 116-K-1 and 116-K-2 facilities most of the time, and not from the retention basins.

Recommendation:

In Column Five under "Process stream received/handled," the text should be modified as follows:

116-K-1 Direct discharge of cooling water effluent on one or two occurrences of high activity due to fuel element failure.

116-K-2 Direct discharge of cooling water effluent at times of high activity due to fuel element failure. On a few occasions, high activity effluent was taken through the retention basins and then discharged.

Response:

Accept.

3-4 Deficiency: Table 3-1, p. WP 3-5

In Column Six for the facilities 107-KE and 107-KW basins, the total radioactivity is reported as 6.2 Ci soil/fill and 3.9 Ci soil, respectively. Are these data for soil outside the basins or for the inside basin contents. If the data is for soil, how was the total radioactivity level determined? If the data is for contents of the basin, what is the volume of the sludge and soil in each basin?

Recommendation:

Provide answers for the above questions.

Response:

The information presented comes from Dorian and Richards 1978, page 2-67 and represents soils adjacent to the basins. The word fill will be deleted as it is misleading. Information provided in the cited report (pages 2-80 and 2-83) indicate that total curies were calculated from averages of surface contamination (1/2' deep), and underground (20' deep), for all isotopes, and then summed.

3-5 Deficiency: Table 3-1 and Figure 3-1, p. WP 3-6 and WP 3-3

Cannot find 118-K-1 on the figure.

Recommendation:

Include on the figure.

Response:

Accept.

3-6 Deficiency: Table 3-1 and Figure 3-1, p. WP 3-9 and WP 3-3

Cannot find 1607-K-5 on the figure.

Recommendation:

Include on the figure.

Response:

Accept.

3-7 Deficiency: Section 3.1.1.1, p. WP 3-12, second paragraph

In the last sentence, the text states, "Predominant radionuclides present in the soil column as a result of cooling water leaks and waste disposal are ^3H , ^{60}Co , ^{63}Ni , ^{90}Sr , ^{137}Cs , and $^{152,154,155}\text{Eu}$." The basins are supposed to retain cooling water effluent with short-lived radionuclides. The contamination of soil with the above long-lived radionuclides around the basins indicates that high activity cooling water effluent during fuel-cladding failure was taken through the basins. However, the information provided in the work plan is insufficient to confirm this.

Recommendation:

More information on the record of operations of the cooling water effluent retention basins is needed for RI Phase I activities for the 100-KR-4 operable unit, as well as for the 100-KR-1 operable unit.

Response:

No adequate records have been located to date concerning fuel cladding failures, however, comments from knowledgeable employees indicate that fuel element failures were often not caught before release of effluent to the basins.

3-8 Deficiency/Recommendation: Tables 3-3 through 3-6 and Table 3-11

The analytical test methods and detection limits for each analyte should be included.

Response:

This information was not reported in the cited reference and attempts to locate it have proven fruitless thus far.

3-9 Deficiency: Section 3.1.1.1.1, Table 3-2, p. WP 3-14

A summary of radionuclide inventories for the 107-K retention basins in 1976 is given. However, data for each individual basin is not reported.

Recommendation:

Instead of reporting total values for the three tanks each in 107-KE and 107-KW, provide the data for each individual 107-KE and 107-KW basin. In addition, discuss the approximate quantity of sludge and filling material present in each basin. This information would help to quantify the amount of radioactive substances present in each tank, for further investigation and feasibility study.

Response:

Figure 3-3 and Table 3-3 provide information on individual samples within the 107 basins. The amount of sludge was reported to average

approximately 1/4", and for fill was approximately 2' in all basins at the time of sampling.

3-10 Deficiency/Recommendation: Table 3-3, p. WP 3-15

It is unclear what "1P/Scalar" represents. Also, the unit c/m in Column Six should be defined. Explain numbers such as <200/40. What do the numerator and denominator numbers represent?

Response:

Will explain in text.

3-11 Deficiency: Table 3-3, p. WP 3-15

This table presents the radionuclide concentrations inside the 107-KE and 107-KW basins. It appears from the sample depth that the samples were collected from the filling material of the retention basins. Is there any data on the sludge deposited in the bottom of the basins? Also, the concentrations of the surface samples are higher than the depth samples for some of the radionuclides. This indicates that there is a possibility for continuous release of radionuclides to the atmosphere.

Recommendation:

Present the data for each basin and discuss the extent of contamination in each basin. This would help to understand the magnitude of contaminants already released to the atmosphere or ground water via soil contamination or continuous release of radionuclides from each basin. In general, discuss the numbers in the Table 3.3 with respect to spatial distribution of contaminants within each basin. Provide the background level and the analytical detection limit in the table.

Response:

The table represents both fill and sludge results. For each sample number the deepest sample represents the sludge. Table will be modified to indicate this. A discussion will be added to describe the relative extent of radionuclide contamination within the basins. Background levels have not been agreed upon and the analytical detection limits are unavailable for this data.

3-12 Deficiency: Section 3.1.1.3, Figure 3-3, p. WP 3-17

The unit for "ELEV" is not given in the table for "Trench and Crib Sample Hole Data." The elevation for Hole B is given as 0.00 in the table. Is this value correct? The elevations for Holes D and E inside the crib are given as 430.17 and 420.88. These values show that there is a difference in elevation of 10 feet between Holes D and E. This indicates that a substantial amount of surficial deposits occurred in the crib.

Recommendation:

Provide the unit for "ELEV." Explain the value 0.00 for elevation at Hole B. Discuss the surface undulations inside the crib with respect to surface contours due to soil erosion from nearby sources. Since the crib is located very close to the effluent trench, there is a possibility of soil deposits during overflow from the trench.

Response:

Units for elevation will be given. Currently the crib has a relatively flat bottom and sloping sides. The information was obtained from Dorian and Richards 1978 report page 2-84 which shows this figure in very poor quality. The information in Figure 3-3 will be rechecked.

3-13 Deficiency: Table 3-4, p. WP 3-20

Table 3-4 presents radionuclide concentrations inside and adjacent to the 116-K-1 crib. According to the data for Holes D and E, the concentrations of surface samples from Holes D and E are higher than the depth samples for most of the radionuclides. This indicates an immediate threat of release of radionuclides to the environment. It further confirms that the contaminants have either migrated from the nearby sources to the crib through surficial deposits during storms, or have persisted at the site due to less permeable soil.

Recommendation:

Explain this table more thoroughly, with respect to lateral and vertical migration of contaminants within the crib and adjacent to the crib.

Response:

Areas such as these have been "remediated" by covering with fill or by removal actions. The data does not represent migration of contaminants but areas where the crib had overflowed and contaminants deposited (sorbed) in place.

3-14 Deficiency/Recommendation: Table 3-5, p. WP 3-24

The data in Table 3-5 should be evaluated to determine the extent of contamination within the trench, especially the lateral and vertical movement of the contaminants.

Response:

In an evaluation prior to writing the work plan it was determined that no clear pattern exists from this data other than a general trend towards high levels of contaminants in the shallower samples, which was noted. Furthermore, lateral migration has probably not occurred to any

great degree.

3-15 Deficiency/Recommendation: Section 3.1.1.3.1, p. WP 3-37

The reference in the first line from top, "A.P. Larrick (1985)" should be included in the list of references.

The reference in the sixth line from bottom of the page, "Dorian (1985)" should be included in the list of references.

Response:

Accept.

One is a reference to an internal memo from A.E. Demers to A.P. Larrick that is now WHC-MR-0169.

3-16 Deficiency: Table 3-12, p. 3-39

In Table 3-12, the unit for radionuclide concentrations is given as pCi/L. However, the text makes no mention whether the samples are sludge, effluent, or soil. It appears from the table that the samples are taken from pits, basins, and filters.

Recommendation:

Explain clearly the sample matrix used for analysis for each facility shown in the table; and the contaminants contributed from these facilities to the groundwater.

Response:

No report was generated with this data (see comment 3-15) and further checking has been unable to locate additional information.

3-17 Deficiency: Section 3.1.2.1, Table 3-12, p. 3-42

The information contained in this table is of little value without a more detailed explanation of the distribution of the data (i.e., normal, logarithmic) and how the averages and standard errors were calculated.

Recommendation:

Report the minimum and maximum concentrations of on-site and off-site soil contamination, rather than the averages.

Response:

Accept.

3-18 Deficiency/Recommendation: Section 3.1.3.1, p. WP 3-44, first

paragraph

In the third line, substitute "1989" for "1988."

Response:

Accept.

3-19 Deficiency: Section 3.1.2.1, p. WP 3-44

Assumption that background groundwater quality at the 100-K Area is similar to Hanford site-wide background groundwater quality may be wrong. If there is significant influx of river water, background groundwater quality may be greatly influenced by the water quality of the Columbia River.

Recommendation:

Use site-wide background data as given, but indicate possible complication related to river water influx.

Response:

The text mentions three possible reasons that K Area background might be different from sitewide, one of which is influence of the river.

3-20 Deficiency: Section 3.1.3.2.1 and Table 3-15, p. WP 3-46 and WP-49

There is no discussion of the effect of the river on water temperatures. Well K-20 shows extreme temperature fluctuations (from 3 to 7 degrees change in a few days or less; see 9/15+17/85, 11/2+16/85, and 4/23+24/85).

Recommendation:

Indicate relationship between river and groundwater system.

Response:

Accept. Will mention river water temperature.

3-21 Deficiency: Table 3-16, p. WP 3-51

Why include dates with no data (dashes)?

Recommendation:

Remove.

Response:

Accept. Delete these dates.

3-22 Deficiency/Recommendation: Table 3-17, p. WP 3-56

The unit for nitrate concentration should be provided.

Response:

Accept.

3-23 Deficiency: Figure 3-6 and Table 3-15, p. WP 3-58 and WP 3-49

Figure and table don't match. K-29 and K-30 have only 2 or 3 values in table, but each has 7 values in figure. K-27 has additional value on figure (~ 16.4 on ~ 9/85) not in table.

Recommendation:

Make figure and table agree.

Response:

Accept.

3-24 Deficiency: Figure 3-7 and Table 3-15, p. WP 3-59 and WP 3-49

Figure and table don't match. K-11, 6-66-64, and 6-72-73 have 20, 3, and 3 values in table and 7, 9, and 6 values in figure.

Recommendation:

Make figure and table agree.

Response:

Accept.

3-25 Deficiency: Figure 3-8 and Table 3-15, p. 3-60 and WP 3-49

Figure and table don't match. K-19 and K-20; not all values in table are shown on figure. K-22 has value of ~23 on ~11/2/85 in figure, but not in table.

Response:

Accept.

3-26 Deficiency: Figure 3-10, p. WP 3-62

Should 6-66-84 be 6-66-64?

Recommendation:

Check and correct.

Response:

Accept. Will proof the figure.

3-27 Deficiency: Section 3.1.3.2.1, p. WP 3-67

The stated average temperatures for groundwater and seeps (15-19 and 11-13 degrees, respectively) indicate that the seeps are a mixture of groundwater and surface water (bank storage).

Recommendation:

Include discussion of the apparent component of surface water in the discharge from the seeps. This relationship should also be more fully indicated in all discussions of the seeps.

Response:

Accept. Point out influences of bank storage; delete "shallow source" statement.

3-28 Deficiency: Section 3.1.3.2.1, p. WP 3-67

The higher temperatures (13 to 15.4 degrees) in some seeps do not necessarily reflect a "shallow" source. The higher temperatures may simply reflect a smaller amount of surface water (bank storage) mixed with the groundwater at these sites.

Response:

Accept. Point out influences of bank storage; delete "shallow source" statement.

3-29 Deficiency: Section 3.1.3.2.1, p. WP 3-69, second and third paragraphs

The second and third paragraphs on this page were placed under the nitrate section, but should be under the hexavalent chromium section.

Recommendation:

Move the paragraphs under the hexavalent chromium section (on the same page).

Response:

Accept.

3-30 Deficiency: Section 3.1.3.2.1, p. WP 3-69

The low nitrate concentrations in the seeps do not indicate that the

nitrate contamination in the groundwater is dissipating or not reaching the river. This may be further evidence that the seeps reflect a large amount of bank storage (river water is very low in nitrate). Groundwater discharge to the river (either from observable seeps after longer periods of low river stage than indicated by the available seep data or from unobserved discharges [below river stage] may be carrying significant concentrations of nitrate to the river.

Recommendation:

Remove the statement.

Response:

Accept.

3-31 Deficiency/Recommendation: Section 3.1.6.1, p. WP 3-79

In the second line from the bottom of this page, the reference "circa 1980" is not listed. Include the reference in the reference list.

Response:

Circa 1980 is not a reference.

3-32 Deficiency/Recommendation: Section 3.1.6.2, p. WP 3-83

In the second line from the bottom of this page, substitute "1981" for "1982."

Response:

Accept.

3-33 Deficiency/Recommendation: Section 3.1.6.2, p. WP 3-84

The reference in line one from the top, "Blus et al., 1985," should be listed in the list of references.

The reference in line four from the top, "Cadwell and Fitzner, 1984," should be listed under the references.

Response:

Accept.

3-34 Deficiency/Recommendation: Section 3.1.7.1, p. WP 3-84, first paragraph

Given the relationship of the 116-KE-4 retention basins to the ground-water mound shown in Figure 2-19, and the distribution of ground-water contaminants shown in Figure 3-5, the vadose zone underlying the

retention basins should be listed as a major source of contamination.

Response:

It is true that the sediments are a source of contamination. However, the list contains primary sources. The vadose zone source is mentioned in the text immediately following the list.

3-35 Deficiency: Figure 3-15, p. WP 3-85

In Figure 3-15, "humans" are not considered as "receptor." Direct contact of surface water or spring water could be a source for human contact. Refer also to text in Sections 3.1.7.4, 3.3.1.4, and 3.3.1.5, for water use by humans.

Recommendation:

Include "Humans" as a receptor in the "Site Conceptual Model."

Response:

Accept.

3-36 Deficiency: Figure 3-15, p. WP 3-85

100-KR-1 is not listed as a primary source.

Recommendation:

Add 100-KR-1 to the primary sources.

Response:

Accept.

3-37 Deficiency: Section 3.1.7.1, p. WP 3-87, second paragraph

This paragraph states that one of the highest-known concentrations of beta-gamma radiation occurs in soil beneath the basins. However, supporting data was not presented in Section 3.1.1.1.1, and it is not clear if testing underneath the retention basin foundations was conducted or where the samples were collected.

Recommendation:

The concentrations of radionuclides in the soils underlying the retention basins, or the activity of the soils, should be reported in Section 3.1.1.1.1.

Response:

This should read "adjacent to" not "beneath."

6
6
5
1
5
6
3
0
1
0
6

3-38 Deficiency: Section 3.1.7.2, p. WP 3-88

The statement "...the vadose zone may have locally been as much as 20 feet thinner..." appears to understate the change. Comparing figures 2-17 and 2-19, it appears that the maximum change is 25-30 feet.

Recommendation:

Change 20 feet to 30 feet.

Response:

Accept.

3-39 Deficiency: Section 3.1.7.2, p. WP 3-89

Estimate of natural infiltration rate on the order of tenths of an inch per year may be underestimated. Lysimeter studies (Gee, 1987) indicate a value of about 10cm (~4 inches) for bare, coarse-textured soils (at least some of the area presumably fits this description; especially fill areas where vegetation has been controlled).

Response:

Accept, partially. It is the intent of this section to present a conceptualization of the characteristics of the vadose zone. The current conceptualization is that contaminant movement through the vadose zone is much slower than it was during periods of effluent disposal. A range of values for recharge will be provided with references.

3-40 Deficiency: Section 3.1.7.2, p. WP 3-89

The statement that current contaminant migration rates are "extremely low" is not supportable with present data.

Recommendation:

Remove statement.

Response:

Accept, partially. It is the intent of this section to present a conceptualization of the characteristics of the vadose zone. The current conceptualization is that contaminant movement through the vadose zone is much slower than it was during periods of effluent disposal. A range of values for recharge will be provided with references.

3-41 Deficiency: Figure 3-16, p. WP 3-91

The current(?) 105-KE storage basin leak is not indicated.

Recommendation:

Add to the figure.

Response:

To show the leak on the figure at that scale is not appropriate.

3-42 Deficiency: Section 3.1.7.3, p. WP 3-93

It is stated that groundwater flow is toward the river, then the statement is made, "However, at least the upper portion of the shallow aquifer is hydraulically connected with the Columbia River". This implies that the rest of the system is not connected to the river.

Recommendation:

Rephrase (remove "However"). Also, replacing "hydraulically connected" with "directly connected" may be clearer.

Response:

Accept.

3-43 Deficiency: Section 3.1.7.3, p. WP 3-94

What is "groundwater meandering" and how does it induce a vertical gradient? The mound would have produced a downward vertical gradient. The extent to which this downward gradient induced deep contamination is in question.

Recommendation:

Rewrite, indicating existence of downward gradient during occurrence of the mound and remove or rephrase "groundwater meandering" comment.

Response:

Accept. Should be groundwater "mounding." Will clarify.

3-44 Deficiency: Section 3.2.1.1, p. WP 3-96, bottom of page

The text refers to "five" citations, whereas six are listed.

Recommendation:

Change the word "five" to "six."

Response:

Will make text consistent with list.

- 3-45 Deficiency: Section 3.2.1.1.6, p. WP 3-98, bottom of page

The Code of Federal Regulations number is missing. It was given for the other citations listed under Section 3.2.1.1, Federal Requirements (p. 3-96).

Recommendation:

Insert proper the Code of Federal Regulations number.

Response:

Accept.

- 3-46 Deficiency: Section 3.2.1.2, p. WP 3-99, second paragraph

The text refers five regulations, whereas only four are listed.

Recommendation:

Change the word "five" to "four."

Response:

Will make the text consistent with the list.

- 3-47 Deficiency: Section 3.2.6, p. WP 3-111, top of page

The text refers to draft regulations expected to be published in February or March 1990. However, this draft work plan is dated May 1990.

Recommendation:

Reword the statement to reflect the current status of the draft regulations.

Response:

Will reword.

- 3-48 Deficiency: Section 3.3.1.4, p. WP 3-113, last paragraph

The text refers to the potential future use of the site and unrestricted access. No examples of future use are given and unrestricted access is not defined.

Recommendation:

Give examples of potential future use; define unrestricted access.

Response:

Examples of future use are given in Section 3.3.1.5. The term unrestricted access is self-explanatory.

3-49 Deficiency: Section 3.3.2.1, pp. WP 3-115 and WP 3-116

This section is confusing because of the weakness of the first paragraph. The paragraph mentions known or potential chemical contaminants, including sulfate, chlorine ions, chromium VI, copper, mercury, and PCBs. The following paragraphs then discuss the toxicities of chromium VI, copper, mercury, and PCBs, but not sulfate or chloride ions. While sulfate and chloride ions are fairly innocuous, a statement about their toxicities is warranted.

Recommendation:

Reword the first paragraph so that the reader knows what topics will be discussed and in what order. Include a brief statement about the toxicities of sulfate and chloride ions.

Response:

Will reword.

3-50 Deficiency/Recommendation: Section 3.3.2.1, p. WP 3-115, first paragraph

In the first sentence, include "radioactive nuclides" as known or potential contaminants.

In the fifth line of this paragraph, substitute "Chloride ion" for "chlorine ion."

Include "cadmium, lead" in the fifth line as known or potential chemical contaminants present in the environment.

The text refers known or potential contaminants listed in "the table of maximum contaminant concentrations." However, no table number is referenced; and no such table appears to have been developed.

Response:

Will reword.

3-51 Deficiency: Section 3.3.2.2, p. WP 3-116

The first sentence lists persistent contaminants as chromium VI, copper, mercury, PCBs, and radionuclides. Each is then discussed except for PCBs.

Recommendation:

Include a statement about the persistence of PCBs.

Response:

Accept.

3-52 Deficiency: Section 3.3.2.3, pp. WP 3-116 and WP 3-117

The mobility of chromium VI, mercury, radionuclides, sulfate, and chloride is discussed. The mobility of PCBs is not discussed.

Recommendation:

Discuss the mobility of PCBs.

Response:

Accept.

3-53 Deficiency: Section 3.3.2.4, pp. WP 3-117 and WP 3-118

Unit-less bioconcentration factors are given for some of the contaminants found in 100-K area (see Table 3-32, p. 3-118). The table contains copper, chromium, and mercury. No mention is made of the other contaminants of concern in the 100-KR-4 area. Also, the valence for chromium is not specified.

Recommendation:

Include a brief statement regarding the missing contaminant bioconcentration factors. Are they unavailable? Were they looked for? Also, specify the valence of chromium.

Response:

Will clarify the use of this table.

3-54 Deficiency: Table 3-31, p. WP 3-117

Several references are made throughout the work plan to radionuclides that may be found in the 100-KR-4 operable unit. Table 3-31 lists many of these, but does not list ^{41}Ca (p. WP 2-18), ^{90}Sr (pp. WP 2-19, 3-12, 3-15, 3-76), or ^{129}I (p. WP 3-76).

Also, half life units are missing in the table.

Recommendation:

Add the appropriate radionuclides to the table.

Add the appropriate half life unit (years).

Response:

Accept.

3-55 Deficiency: Section 3.3.3, p. WP 3-118, mid-page

First, this section is entitled "Contaminants of Concern." This section follows Section 3.3.2, entitled "Contaminant Characteristics." Contaminant characteristics should not be discussed before the contaminants are identified.

Second, the first sentence refers to Table 3-33, which "lists the preliminary contaminants of concern for the 100-KR-4 operable unit". Only radionuclides are listed in Table 3-33.

Recommendation:

Place the "Contaminants of Concern" section before the "Contaminant Characteristics" section.

Either modify the first sentence to read, "the preliminary radionuclide contaminants," so that Table 3-33 is correct, or modify Table 3-33 to reflect chemical contaminants as well as radionuclides. If the table is modified to reflect all contaminants, then the ones listed on page WP 3-96 (midpage) should be listed, as well as aluminum (component of bauxite, p. WP 2-17), lead, boron, diesel fuel, fuel oil, and petroleum (the last five are referred to on p. WP 3-29).

Response:

Accept.

3-56 Deficiency/Recommendation: Section 3.3.3, p. WP 3-118

Include nitrate and radionuclides as preliminary contaminants of concern for the 100-KR-4 operable unit.

Response:

Will include nitrate. Radionuclides are listed.

3-57 Deficiency: Section 3.3.4, p. WP 3-119, top of page

This section consists of one unclear sentence. The author apparently meant that the risk will be quantified and characterized in an appropriate manner.

Recommendation:

Rewrite this section. Clearly state the objective and method of

obtaining the objective.

Response:

Accept.

3-58 Deficiency: Section 3.3.4.1, p. WP 3-119

This section focuses only on chemical contamination, and mentions PCBs, mercury, chromium, and copper. A broader focus, which includes radionuclides and any other chemical hazard that may be encountered, is needed.

Recommendation:

Include the word radioactive in sentence number two, so that it reads, "magnitude of chemical and radioactive contamination." Modify sentence number three, so that it reads, "hazardous substances such as but not limited to PCBs, mercury."

Response:

Accept.

3-59 Deficiency/Recommendation: Section 3.4.1, p. WP 3-120, mid-page

The text refers to "Section 3.3.3.5." The correct section number is 3.3.3. Also, the reference to Section 5.3.8 is incorrect. The baseline risk assessment is located in Section 5.2.11.

Response:

Accept.

3-60 Deficiency: Section 3.4.4, p. WP 3-125

Should alternative number four read "...pumping and treating and reinjection..."?

Recommendation:

Rephrase.

Response:

Accept.

4-1 Deficiency/Recommendation: Section 4.0, p. WP 4-1, first paragraph

The "to" following "focus" in the last sentence should be deleted.

Response:

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Accept.

4-2 Deficiency/Recommendation: Section 4.0, p. WP 4-1, third paragraph

The "and" following "resources" in the first sentence should be changed to "an."

Response:

Accept.

4-3 Deficiency: Section 4.1.2, p. WP 4-3

It is not clear whether all available information has been compiled or does compilation of existing data continue in RI Phase I?

Recommendation:

Indicate that additional existing data are assumed to exist and that obtaining these data are part of the RI Phase I effort. List some potential data sources: e.g., USGS files, previous studies not cited (Raymond and Brown, 1963).

Response:

Accept.

4-4 Deficiency: Section 4.1.4, p. WP 4-5, first paragraph

The first sentence describes existing data that are insufficient to answer what contaminants are present, their exact location, and their potential to migrate. The concentrations of the contaminants are not included in the text.

Recommendation:

Include "contaminant concentrations" in the text following "what contaminants are present."

Response:

Accept.

4-5 Deficiency/Recommendation: Section 4.1.4, p. WP 4-5, third paragraph

In the first sentence, substitute "will be" for "are."

Response:

Accept.

4-6 Deficiency/Recommendation: Table 4-1, p. WP 4-8

Under the column "Data types," substitute "chemical and radiological properties" for "chemical properties."

Response:

Accept.

4-7 Deficiency: Table 4-1 and Table 4-3, p. WP 4-8 and 4-12

An important objective of the RI is to provide data for the baseline risk assessment. As noted on p. 5-41, the environmental fate and transport mechanisms within specified environmental transport media need to be assessed to conduct a risk assessment. The fate and transport of contaminants in groundwater can be greatly affected by the mineralogy and chemical composition of the aquifer matrix. However, characterization of the aquifer matrix and its interaction with specific contaminants is ignored in the work plan.

Recommendation:

Include chemical characterization of the aquifer matrix as a data objective in Table 4-1, and include data collection type, measurement, and required analytical levels in Table 4-3. Specifically note measurement of distribution and retardation coefficients in Table 4-3. Also note this data collection activity in Section 5.2.6 and in the Field Sampling Plan.

Response:

This detail of research is not justifiable under a Phase I groundwater investigation. Chemistry of the sediments will be measured; so will chemistry of the groundwater. These parameters will allow an approximation of chemical retardation that is acceptable for the purposes of the study.

4-8 Deficiency: Table 4-3 and Section 5.2.2, p. WP 4-11 and WP 5-4

Additional source information can probably be obtained from interviews of personnel who worked in the area. This should be listed as work item.

Recommendation:

Include personnel interviews as a work item.

Response:

Accept.

4-9 Deficiency/Recommendation: Table 4-3, p. WP 4-11

In Table 4-3, page 1 of 3, under column "Data use," add "WS" corresponding to soil gas survey measurements.

Response:

Unclear what is referred to here since soil gas is not listed on the table.

4-10 Deficiency: Section 4.2.5, p. WP 4-15

In the last line, the text states, "Approximately 80% of the samples collected will be Level III; 20% will be Levels IV and V." The statement is unclear.

Recommendation:

State that approximately 80% of the samples collected for nonradioactive chemicals will be Level III and 20% will be Level IV. All samples for radioactive nuclides will be Level V.

Response:

Accept.

4-11 Deficiency/Recommendation: Section 4.3.1, p. WP 4-17, last paragraph

The text refers to "If the long-term risk assessment indicates a potential risk greater than 1×10^{-5} to 1×10^{-6} ." However, later in the work plan, the goal for the lifetime risk of contracting cancer is " 10^{-7} to 10^{-4} " (see Section 5.2.11.4, p. WP 5-45, fourth paragraph on the page). These two statements should be reconciled.

Response:

Accept.

4-12 Deficiency/Recommendation: Section 4.3.2, p. WP 4-18 and WP 4-19

Substitute "vadose zone and groundwater contamination" for "groundwater contamination" wherever applicable in these pages.

Response:

Accept.

5-1 Comment: Section 5.2.2, p. WP 5-4

It is desirable to have a central collecting point (document?) that includes all of the basic data related to a site (original driller's logs, geophysical logs, groundwater data, etc.). Some discussion of how data will be made accessible, to reviewers and public, as well as

project personnel, may be appropriate at this point. The Data Management Plan apparently does not directly address how existing data (e.g., drilling records) will be handled.

Response:

This is beyond the scope of the work plan. Currently, as part of the scoping process, a compilation of data will be done prior to the RI but is expected to be an iterative process. However, this is a valid point and should be the focus of some discussion between all involved parties.

5-2 Deficiency/Recommendation: Section 5.2.2.1, p. WP 5-4

On the first bullet, remove "liquid" so that the sentence reads "Evaluate disposal sites for...".

Response:

Accept.

5-3 Deficiency/Recommendation: Section 5.2.4, p. WP 5-11

In the second line from the bottom, substitute "sediment" for "soil."

Response:

Accept.

5-4 Deficiency: Figure 5-1, p. WP 5-7

The hydrostratigraphic unit indication for each of the proposed wells is very useful; indicating the hydrostratigraphic unit tapped by each of the existing monitoring wells would make the figure even more usable.

Recommendation:

Add hydrostratigraphic unit indicator for all wells.

Response:

Accept. Will add this information where possible.

5-5 Deficiency: Figure 5-1 and Table 5-3, p. WP 5-7 and WP 5-20

Wells K25B and K16 are not in the table.

Recommendation:

Add to the table.

Response:

Well K25B should not have been on figure; it doesn't exist and is not proposed, and will be deleted from the figure. Well K16 is an abandoned well (see figure 5-1) and abandoned wells are not included in table 5-3.

5-6 Deficiency: Figure 5-1, p. WP 5-7

Do "hydrostratigraphic units A-D" refer to aquifers A-D? Both aquifers and confining units are labeled with A-D designations.

Recommendations:

Clarify.

Response:

Accept. Will clarify.

5-7 Deficiency: Section 5.2.3, p. WP 5-9

A single well to the basalt is probably reasonable for Phase I, but one well to the basalt will yield very limited information regarding the possibility of an "erosional window" through the basalt.

Recommendation:

Remove statement implying that this single well will "...determine if there is an erosional window through the basalt...".

Response:

This comment no longer applies because well 34D (the well drilled to basalt) is being removed from the work plan for Phase I.

5-8 Deficiency: Section 5.2.3, p. WP 5-9

Have surface geophysical techniques been eliminated as possible tools to determine the basalt top?

Recommendation:

If not already done, consider surface geophysics and add any appropriate methods.

Response:

Accept. Surface geophysics to define the top of basalt at the K-Area has been considered. However, it was determined that this type of study is beyond the scope of the Phase I investigation. If Phase I

data indicate that contamination is present in significant quantities deep in the unconsolidated sediments, surface geophysics or other methods may be employed to define the configuration at the top of basalt.

5-9 Deficiency: Section 5.2.4, p. WP 5-10

We do not agree that taking water samples from the Columbia River in order to evaluate the impact of seepage would not yield useful information. Such activities have been proposed and approved in other work plans. The main purpose of river sampling is to evaluate the impact of diffuse groundwater seepage through the river bottom sediments. The work plan as proposed provides no data of the quantity and quality of diffuse groundwater seepage nor does it provide an evaluation of the impact of this seepage on the littoral zone, a biologically important riverine environment. Although the quantity of contamination emanating from the 100-K Area groundwater seepage may not be significant when mixed with the total volume of the Columbia River, mixing is not instantaneous, and contaminants may have a localized impact along the shore of the river. This localized impact should be evaluated in the baseline risk assessment, and as such, appropriate field data should be collected.

Recommendation

Sample river water along a transect perpendicular from the shore of the 100-K Area. Concentrate sampling near the river shore, with less frequent sampling toward the middle of the river. There is no need to go beyond the middle of the river. Take a discrete water sample within 1 meter of the bottom at each sampling point along the transect, and take a depth integrated sample throughout the water column. Also, take surface-water samples directly downstream of influent springs to evaluate the impact of spring flow on the river water quality. Refer to the 300-FF-5 work plan for an approved water sampling strategy.

Response:

Accept partially. The third introductory paragraph of this section relates to what might be the more conservative method of estimating the concentration of contaminated groundwater being exposed at the river banks or through the river bed. Unless very highly contaminated groundwater is discharging into the Columbia, it is doubtful that the sampling program for the water column (as recommended by the reviewer) would detect contamination attributable to 100-K operations. Whether or not a very highly contaminated plume is discharging to the river can be more conservatively determined by monitoring wells located near the river, since the dilution by uncontaminated river water is less. Radiological surveys of the river shoreline and analysis of river bank seepage will be used to support interpretations made from well data. Changes to the text in Section 5.2.4, to be made in response to the General Comment on the section, will hopefully remove ambiguities in the existing text.

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The reviewer's recommendation to further investigate the chemical and radiological characteristics of Columbia River water and sediment is definitely appropriate with regard to the Hanford Site's impact on public health and safety, as well as the environment. A program to do so should encompass the river throughout the Site, and be integrated with each of the source and groundwater investigations that are conducted at operable units. It should also consider a sampling scheme to identify other sources of contaminants, such as the waste water ditches on the side of the river opposite Hanford operations (the work plan for 300-FF-5 has attempted to incorporate this strategy in Section 5.3.5.4 "Transect River Water"). An understanding of (1) all the processes that influence the river's water quality, and (2) of the potential for contaminants from past practices to be stored in depositional areas, both require an investigation of the river as a system.

5-10 Deficiency: Section 5.2.4, p. WP 5-11

The statement that the groundwater system reacts to changing river stage should not be restricted to the shallow system. Head changes are propagated into the deeper system as well.

Recommendation:

Rephrase to include effect on deeper system.

Response:

The text does not imply that river stage is only reflected in the shallow groundwater system.

5-11 Deficiency: Section 5.2.4.2.1, p. WP 5-12

What is the difference between "riverbank springs" and "groundwater seeps"?

Response:

Accept. Text will use the term "spring" exclusively.

5-12 Deficiency: Section 5.2.4.2.3, p. WP 5-13, third paragraph

The last sentence states, "Field measurements will be made to determine the seep water temperature, pH, specific conductivity, nitrate, phosphate, and potassium concentrations."

Except for pH, temperature, and specific conductivity, other parameters are not measured in the field unless field equipment is carried to the site for analysis.

Recommendation:

Explain whether parameters such as nitrate, potassium, phosphate will be measured at the site.

Response:

Accept. Rephrase.

5-13 Deficiency:

Best technical judgement and field estimates are poor methods for measuring seep discharges.

Recommendation:

Make volumetric measurements of seeps along the river where possible. Measurements are made by channelizing flow from the seep and collecting water through a plastic pipe attached to a large plastic bag. Volumetric measurements collected in this way are highly accurate and can be made in areas with little slope. Two or three measurements can be made at a time to confirm measurement precision. For large flows, calibrated weirs might be used. We also recommend that seep discharges be made at the time of water-quality sampling and that this be noted in Section 5.2.4.5.

Response:

Accept.

5-14 Deficiency: Section 5.2.5, p. WP 5-18

We do not agree with the assumption that soil physical parameters collected from outside of source areas are representative of conditions within source areas. Source areas in many cases received very large volumes of very hot water. Dissolution of minerals on soil particle surfaces or precipitation of chemical constituents in the process water may have produced considerable changes in the hydraulic properties of soils underlying the source areas.

Recommendation:

We agree that soil hydraulic properties outside of the source areas are indeed important to measure, particularly in those areas in which contaminants may have spread laterally. However, we do not support the application of data collected outside of source areas to the soils directly below sources. These areas must be characterized separately. The characterization of soil hydraulic properties is most appropriately done in the source area RI/FS.

Response:

It is more important in Phase I to characterize the nature and extent

of groundwater contamination, since it represents a more direct pathway to the public than does vadose contamination. As stated in the text of both the KR-1 and KR-4 work plans, physical testing of sediment samples will be conducted, but only if they are not significantly contaminated. The cost and difficulty of analyzing or storing radioactive samples prohibit their inclusion in Phase I.

5-15 Deficiency: Section 5.2.5, p. WP 5-18

It is not clear what will be done to characterize the physical and hydraulic properties of contaminated soils. Since these contaminated soils are potentially significant sources of groundwater contamination, it is important to characterize their hydraulic properties.

Recommendation:

Characterize the physical and hydraulic properties of contaminated soils during Phase I. We understand that a laboratory is being developed to measure the physical properties of radiologically contaminated soils at Hanford. If this laboratory is not fully operational, archive contaminated soil samples for future analyses.

Response:

It is more important in Phase I to characterize the nature and extent of groundwater contamination, since it represents a more direct pathway to the public than does vadose contamination. As stated in the text of both the KR-1 and KR-4 work plans, physical testing of sediment samples will be conducted, but only if they are not significantly contaminated. The cost and difficulty of analyzing or storing radioactive samples prohibit their inclusion in Phase I.

5-16 Deficiency: Section 5.2.5.1, p. WP 5-19

The assumption that contaminants present below the water table are in equilibrium with groundwater is not acceptable. The flow system in the 100-K Area is expected to be very dynamic with respect to river fluctuations. The flow directions and residence time of groundwater in contact with a given aquifer matrix are expected to vary considerably in relating short time periods. Under these conditions, groundwater quality may serve as a poor indicator of the chemical quality of the aquifer matrix, and to assume equilibrium and to quantitatively apply the results is not acceptable.

Recommendation:

As noted in the comment pertaining to Table 4-1, characterization of the chemical quality of the aquifer matrix is important to define potential source terms of contamination as well as to measure the retarditive coefficients and to define potential fate and transport mechanisms. We, therefore, recommend collecting samples of saturated soils to provide a medium for those analyses. Samples to evaluate

contaminant source terms are most appropriately collected in a source operable unit RI/FS (100-KR-1) and samples to evaluate retardation coefficients are most appropriate to collect in a groundwater operable unit RI/FS.

These analyses are required for a baseline risk analysis and are, therefore, appropriate for Phase I investigations. We are also unaware of "other Hanford programs" that will provide this information as noted in paragraph 2 of Section 5.2.5.1.

Response:

Accept. Will revise text to state that sediment samples for chemical analysis will be collected 5 ft below the current water table.

5-17 Deficiency: Section 5.2.5.2, p. WP 5-19

In paragraph I, it is noted that "Emphasis has been given to analyze for contaminants known to be relatively immobile." We assume that should read relatively mobile.

Recommendation:

Change to read mobile, or explain in detail the reasoning behind focusing on immobile contaminants.

Response:

Accept to clarify. We're looking for contaminants in the soil; therefore we focus on stuff that's immobile in groundwater and more liable to be found in the sediments. Will reword.

5-18 Deficiency: Section 5.2.5.2, p. WP 5-23

We could find no more detailed information on field screening in the Field Sampling Plan (Attachment I, Part 1) as noted here. We do support a comprehensive field and laboratory screening procedure using spectral gamma, XRF, and head-space GCMS analyses.

Recommendation:

Include a detailed discussion of field and laboratory screening in the FSP. Refer to the 300-FF-1 work plan for an appropriate strategy and reference appropriate Westinghouse guidance documents.

Response:

The objective of the surface radiation sampling and analysis task in the 300-FF-1 work plan is to locate areas of contamination and to determine background surface radiation conditions. The objective of field screening for radiation in the 100-KR-4 work plan is just to determine what to select additional parameters for samples collected

while drilling wells. Thus the detail provided in the 300-FF-1 work plan is not justified here.

5-19 Deficiency: Section 5.2.6, p. WP 5-27

Statement that some wells might be used to assess the impact of the Columbia River "...depending on their depths relative to...the river" is incomplete. All wells can be used to assess the impact some will show more effect than others.

Recommendation:

Indicate that all wells will be used to test impact of the river.

Response:

Accept.

5-20 Deficiency: Section 5.2.6, p. WP 5-27

Use of the term "background" well for the upgradient "B" wells may be misleading (indicating background water quality).

Recommendation:

Use term "upgradient" in place of "background".

Response:

Accept.

5-21 Deficiency: Section 5.2.6, p. WP 5-28

One well in the "D" unit will not determine contaminant distribution in the unit.

Recommendation:

Rephrase.

Response:

This comment no longer applies because well 34D is being removed from the work plan for Phase I.

5-22 Deficiency: Section 5.2.6.2.1, p. WP 5-29

Is any geophysical logging planned for existing wells?

Recommendation:

These wells should be considered for logging. In particular, any wells

with geophysical logs predating site operation (see comment on Table 2-3, p. WP 2-39) should be considered to see if operations significantly changed physical properties.

Response:

Accept. Possibility of logging existing wells will be examined in the early stages of Phase I. However, some of these wells have double casings and would not yield useful geophysical data.

5-23 Deficiency: Section 5.2.6.2.2.3, p. WP 5-32

In recent Unit Managers' Meetings (5/17/90 and 7/18/90), it was stated that gamma-gamma and neutron-epithermal neutron logs were not useful tools (not properly calibrated for Hanford conditions) and a different tool was proposed (Radionuclide Logging System).

Recommendation:

Discuss what is expected to be obtained from each type of geophysical log and the major drawbacks/weaknesses of using each in the 100-K Area.

Response:

The RLS is still being developed. It may be used in the 100-KR-4 investigation; however, use of all logs is at the discretion of the well site geologist.

5-24 Deficiency: Section 5.2.6.2.2.4, p. WP 5-32

It is proposed that the new monitoring wells be completed with 4-inch casings. However, it is also later stated that aquifer tests may be conducted on some wells at a later date (Phase II). Four-inch casings will probably not allow for pumps of sufficient capacity to stress the aquifers significantly.

Recommendation:

Install larger diameter casings or plan for additional well drilling (large diameter test wells) in Phase II.

Response:

Accept, partially. The primary purpose of the planned wells is for groundwater monitoring, not aquifer testing, so they have been designed accordingly. If it is determined in Phase I that large-scale pumping tests requiring larger-diameter wells are required, additional wells will be installed for that purpose. This information will be included in the "aquifer testing" section of this work plan.

5-25 Comment: Section 5.2.6.2.2.6, p. WP 5-33

We are unfamiliar with Hanford Plant surveying standards. For RI/FS investigations, it has been agreed that 3rd order surveys will be conducted with 2 ft horizontal and .1 ft vertical accuracy standards. These standards are noted in a Westinghouse EII.

Response:

Accept. Will refer to EPA's Compendium of Superfund Field Operations Methods for survey standards.

5-26 Deficiency: Section 5.2.6.2.3, p. 5-33

Will monthly water levels be sufficient? The effects of river stage changes may make monthly measurements worthless.

Recommendation:

Install transducers (as planned) and collect data for a sufficient period (a period in which river stage fluctuates through its normal daily cycles and experiences some long-term change; probably one or two months). Inspect transducer data to see the effects of river stage and then determine the needed frequency of water level measurements (it may be determined that only transducer records will be of any value).

Response:

Accept.

5-27 Deficiency: Section 5.2.6.2.5, p. WP 5-35

Quarterly sampling may be inadequate if significant influx of river water occurs.

Recommendation:

Test effect of river stage changes on water quality by measuring some indicator parameter(s) (e.g., specific conductance, temperature) during river stage changes; perhaps in conjunction with the initial transducer network (see above comment on frequency of water level measurements). After this initial monitoring, frequency of sampling should be determined.

Response:

Accept. For the first six months of monitoring, selected wells will be sampled monthly for the reduced list of constituents (rather than quarterly). After this period, future sampling frequency will be established.

5-28 Comment: Section 5.2.6.4.3, p. WP 5-36

In order to transfer and compare results from our operable unit to

another, it was agreed that a standard set of models would be used at Hanford. Both saturated and unsaturated flow and solute transport models have been selected and are being supported by site contractors for use in the Hanford RI/FS investigation. These models (Unsat-H, VAM 2D, and PORFLO-3) should be used in the 100-KR-4 RI/FS and specifically noted in Section 5.2.6.4.3.

Response:

Accept.

5-29 Deficiency: Section 5.2.8.1, p. WP 5-39 fourth paragraph

It is not stated in the work plan what constitutes "significant results".

Recommendation:

The most obvious type of "significance" is statistical comparison with either background levels or with toxicity-based criteria. Because sampling will probably be limited, true statistical comparisons are not likely to be possible. Therefore, simple comparisons of exceedances of target levels is recommended. For the priority pollutants, it is suggested that the chronic ambient water quality criteria for the protection of freshwater organisms be used as the guidelines for surface waters and that the ER-L values of Long and Morgan (1990) be used as the sediment guidelines. For the radionuclides, it is stated in the work plan that background samples for surface water and sediments were collected from the vicinity of Priest Rapids Dam above the site. Concentrations of radionuclides detected in the samples from near the Priest Rapids Dam (and from any future samples from that area) could serve as "background" levels for comparison to data from areas adjacent to and downstream of the Hanford Site. For this preliminary effort, elevations above the reference (criteria or background) concentrations should be considered "significant" and should warrant more detailed evaluation.

Response:

Accept. Will expand the discussion.

5-30 Deficiency: Section 5.2.11.1, p. WP 5-42, mid-page

The last sentence discusses the basis for selecting contaminants. To be consistent with the previous sections (Contaminant Characteristics, Section 3.3.2, p. WP 3-115), persistence and mobility should also be listed.

Recommendation:

Include persistence and mobility in the last sentence.

Response:

Accept.

5-31 Deficiency/Recommendation: Section 5.3.4.1, p. WP 5-56, first paragraph

The Feasibility Study (FS) should include the name, phone number of the contact person and should include the contractors and vendors of process options evaluated during the FS.

Response:

The section merely summarizes the basic information included in the report and does not get into such details. This comment would best be suited for review of the FS Report.

6-1 Deficiency: Figure 6-1

Footnote 2 indicates that a total of 950 feet of drilling will be required for installation of 23 wells. This equals an average depth of 411 feet per well and a total of 24 days of drilling time for 4 cable-tool rigs drilling at 10 ft/day. The average depth to water in the 100-KR Area is about 70-80 feet, therefore, the 41 foot average depth of the wells and total drilling depth of 590 feet are underestimated. Also, the time line in Figure 6-1 shows approximately 11 months to complete the estimated 24 days of drilling. Even allowing for set-up and decon time for the rig, there is an obvious discrepancy in time estimates.

Recommendation:

Review the estimated drilling depth and time, correct the calculations, and note the correct estimates in the footnote. Include estimates for set-up and decon of the drill rig. Also, separate out drilling from other groundwater field activities on the time line and support the estimated time with accurate calculations in the footnote. Also, describe what field activities will be conducted after the last quarterly water sample is taken as shown on the critical path.

Response:

Accept. will reestimate these figures.

6-2 Deficiency: Figure 6-1

The Phase I RI report including the baseline risk assessment is noted to be issued 13 months after the last quarter groundwater sample is collected. This long timeframe is largely due to a 9-month lag between collection of the last water sample and completion of the data evaluation.

Recommendation:

Shorten the critical path timeframe by shortening the data evaluation phase of the groundwater investigations following the collection of the fourth quarterly water samples. Data evaluation should be complete within 6 months or less of the last quarterly water sample. This should reduce the critical path time period for completing the Phase I RI and baseline risk assessment by about 3 months.

Response:

Will review the schedule and make appropriate corrections.

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**TECHNICAL REVIEW COMMENT
100-KR-4 OPERABLE UNIT
RI/FS WORK PLAN ATTACHMENT 1, PART 1
FIELD SAMPLING PLAN**

1. **Deficiency:** Section 3.1, p. FSP-5, first paragraph

The geologic map is proposed at a scale of approximately 1:500, using the topographic map as a base map. However, the topographic map is proposed at a scale of 1:2000.

Recommendation:

Both the topographic and geologic maps should be at a scale no smaller than 1:300, which is the scale of the 100-KR-4 site plan provided in Plate 2 of the work plan. However, a slightly larger scale, such as 1:200, would be preferable.

Response:

The topo map is being prepared for the entire Hanford Site (1:2000, 2 ft contours). The K Area portion will be "blown up" for the geologic mapping (1:500).

2. **Deficiency:** Section 4.1.3, p. FSP-8

How long will the "low river flow periods" be maintained prior to sampling? Will samples consist of a one-time grab?

Recommendation:

Seeps should be monitored for selected indicator parameters (e.g., specific conductance and temperature) to determine the changes related to bank storage. Sampling should be done only when these parameters indicate a "steady-state" has been reached.

Response:

Accept. If possible, sampling of springs will take place several hours after low flow has been established. Field parameters will be monitored. If these methods are not possible, samples will be taken during low flow.

3. **Deficiency:** Section 4.1.3, p. FSP-8

Spring and seep samples are noted to be collected coincident with biannual groundwater sampling rounds. It is our understanding that groundwater samples will be taken quarterly, not biannually.

Recommendation:

State which of the quarterly groundwater sampling periods will correspond to seep sampling. Also note in the first paragraph what criteria will be used to determine what constitutes a substantial seep.

Response:

Accept.

4. Comment: Section 4.1.6, p. FSP-9

Please note that the river-stage recorder will be surveyed to a datum common to the observation wells.

Response:

Accept.

5. Deficiency: Section 4.2, p. FSP-9

The frequency of measurement of the "field parameters" is not clear from the statement "...will be measured while collecting water samples..." Will field parameters be measured once/before and after/continuously?

Recommendation:

Clarify.

Response:

Accept.

6. Deficiency/Recommendation: Table FSP-1 and Table FSP-2, p. FSP 10-11

Several parameters are listed for which corresponding analytical methods and data quality objectives have not been included in the QAPP, such as 2,4,5 TP Silvex, Gross Alpha, Sulfamate, etc. Under the "short list" herbicides, pesticides, etc., should include specific parameters or reference a specific parameter list. "General" and "Chemistry" are listed as parameters under Field Parameters. List correct parameters or lists.

7. Deficiency/Recommendation: Section 5.2, p. FSP-21, first paragraph

If the field screening indicates that a sample has a radiation level that exceeds 200 counts per minute, the sample depth and locations should be documented along with the method of handling or disposing of the sample.

Response:

Accept.

8. Deficiency: Table FSP-4, p. FSP-22

What does "initial" mean in "Recorder Network" column?

Recommendation:

Define.

Response:

Accept.

9. Deficiency: Table FSP-4, p. FSP-22

Why are recorders scheduled for all of the piezometers at K34 except K34A, while at K42 only K42A has a recorder scheduled?

Recommendation:

Explain.

Response:

Accept. Table will be revised.

10. Deficiency: Table FSP-4, p. FSP-22

Need recorder in well to the south of the area to observe inflow from 200 Areas.

Recommendation:

Include additional recorder (66-64).

Response:

Monthly measurements in the wells to the south will be frequent enough. The transducers are aimed at short-term fluctuations from the river.

11. Deficiency: Table FSP-4, p. FSP-22

Need well(s) close to river to use in river-stage transmissivity calculations.

Recommendation:

This will probably involve an additional well(s) to those presently in the plan. The placement of this well should be determined after the exercise of initial identification of the river-stage effect discussed in comment on Section 5.2.6.2.3, p. WP 5-33.

Response:

It may be possible to perform river stage transmissivity calculations with the currently proposed and existing wells near the river. A similar method was used in the 100 N Area (Brown and Rowe, 1960) using wells 500 to 1000 ft from the river. If Phase I data show that the wells in the 100-K area are too far away from the river and if it looks like river stage transmissivity calculations would be useful enough, additional wells will be proposed for later phases of the investigation.

12. Deficiency: Table FSP-4, p. FSP-22

Why recorders on both K19B and K20B? Both are approximately the same distance from the river.

Recommendation:

Change recorder from K20B to K41B, this would give better definition of river-stage effect (it would be roughly in line with K19B, perpendicular to the river).

Response:

Accept partially. K20 is part of a line of recorders parallel to the river. Well 41b will also be equipped with a recorder, however. Each well in a cluster will be equipped with a recorder. Several other revisions to the recorder network will be made to the lines parallel and perpendicular to the river are better defined.

13. Suggestion: Table FSP-4, p. FSP-22

Perhaps recorders on all wells at clusters would give the best distribution of data.

Response:

Accept.

14. Deficiency: Section 6.1.2.2.1, p. FSP-28

Screening of "A" wells "across the water table" is not completely clear. What is the length of the screened interval? Will the water table vary sufficiently that initial placement of screen could wind up with dry wells during some part of the year? What is the depth of screened interval for other units?

Recommendation:

Specify screen plans in more detail.

Response:

It is out of the scope of this document to include well specifications.

15. Deficiency: Section 6.1.2.2.1, p. FSP-28

Screening of "A" wells across the water table may create a situation where screened interval straddles both the low permeability "A" unit and the producing "A" unit. Where this happens, aquifer testing will be meaningless, or at least ambiguous, because the response will reflect some average of the two units.

Response:

The primary purpose of these wells is groundwater monitoring. It is important to have wells that monitor the top of the saturated zone. Wells should not be designed for aquifer testing at the expense of groundwater monitoring.

16. Deficiency: Section 6.1.2.2.1, p. FSP-28

There are no wells designated for confining layers C and D. However, some hydraulic property data will be needed for these units.

Recommendation:

Perhaps these wells can be slug tested during drilling when open to these units.

Response:

Accept. Will try to perform slug tests in these units as they are penetrated by deeper boreholes.

17. Deficiency: Section 6.1.2.3.2, p. FSP-30

See comment on Section 5.2.6.2.2.3, p. WP 5-32

Response:

Geophysics are not planned (see resolution WP 5-8).

18. Deficiency: Section 6.1.2.4, p. FSP-30

"...minimum of 24 to 72 hours..." is meaningless. It says that 24 is the minimum.

Recommendation:

Clarify minimum time.

Response:

Accept.

19. Deficiency: Section 6.1.2.5, p. FSP-30

Does the term "existing wells" include all wells or only those existing wells to be included in the monitoring network?

Recommendation:

Clarify. Some of the existing wells which will not be included in the monitoring network may warrant surveying due to available geologic data or historical water-level or water-quality data.

Response:

Accept. Will survey all existing wells and new wells.

20. Deficiency: Section 6.1.3, p. FSP-31

The line of well perpendicular to the river may require an additional well inland from those shown.

Recommendation:

Add an inland well (e.g., K39A or K37A).

Response:

Accept.

21. Deficiency: Section 6.1.3, p. FSP-31

How long is an "extended period"?

Recommendation:

Replace "extended period" with some estimate of time.

Response:

Accept. Delete this sentence.

22. Comment: Section 6.1.4, p. FSP-32

Aquifer tests were conducted in the 100-K Area by the USGS for the AEC in 1949. These tests used K-10 as the pumping well and K-11 and K-12 as observation wells. Both a step-drawdown and a 48-hour continuous drawdown, and recovery, test were conducted. The data from these tests are available in USGS files and should be analyzed early in Phase I.

Response:

Accept. These data will be analyzed, but as part of subtask 6 (no change to text required).

23. Comment: Section 6.1.4, p. FSP-32

Newcomb and Brown (1960) recorded water levels and river stages in the area near 100-K. Some of these data may be useful in a wave propagation calculation.

Response:

Accept. These data will be analyzed, but as part of subtask 6 (no change to text required).

24. Deficiency: Section 6.1.5.1, p. FSP-32

The frequency of sampling may be insufficient (see comment on Section 5.2.6.2.5, p. WP 5-35).

Recommendation:

See recommendation in comment on Section 5.2.6.2.5, p. WP 5-35.

Response:

Accept. See resolution 5-27.

25. Deficiency/Recommendation: Section 8.2, p. FSP-36, first paragraph

State whether existing baseline data is available for the concentrations of radionuclides in reed canary grass and asparagus, and tritium in leaf water in mulberry and willow trees. If the data is not available, or is of questionable quality, then perform a baseline study as part of this task.

Response:

Accept.

26. Deficiency: Section 9.2, p. FSP-36, first paragraph

A topographic map at a scale of 1:2000 is inadequate for the purposes of the 100-KR-4 operable unit RI/FS.

Recommendation:

The topographic map should be at a scale no smaller than 1:300, which would be consistent with the existing 100-KR-4 site plan (Plate 2 of the work plan). However, a scale of 1:200 would be preferable for an area the size of the 100-KR-4 operable unit.

Response:

See related comment FSP-1.

27. Deficiency/Recommendation: Section 10.3, p. FSP-43

All sample handling should be conducted in accordance with DOT Federal regulations and the EPA User's Guide (EPA, 1988c).

Response:

These regulations are already addressed through the EIIs.

28. Deficiency/Recommendation: Section 10.4, p. FSP-43

Include a brief description of the decontamination procedure instead of only referencing "EII."

Response:

Accept. Will add a very brief description of decontamination.

TECHNICAL REVIEW COMMENTS
100-KR-4 OPERABLE UNIT
RI/FS WORK PLAN ATTACHMENT 1, PART 2
QUALITY ASSURANCE PROJECT PLAN

1. Deficiency/Recommendation: Section 3.0, p. QAPP-5

The data quality levels presented are not consistent with the EPA data quality levels cited in the EPA Data Quality Objectives (DQO) document (EPA, 1987). Phrases such as "a CLP-qualified laboratory" and "approximate the requirements of the CLP for Level IV analysis" are too vague. Also, the CLP does not have a qualification program. Ensure that these are consistent with McCain and Johnson, 1990.

Response:

Will reword.

2. Deficiency/Recommendation: Table QAPP-1, p. QAPP-7

The table is incomplete for many parameters, and inappropriate methods have been referenced for others. For all Target Analyte List (TAL) and Target Compound List (TCL) parameters the corresponding CLP Statement of Work (SOW) methods should be used and cited. In particular, EPA 600 series methods should not be cited. The EPA 600 series methods are not EPA-600/4-79-020 methods as indicated by the footnote "d." The footnote "e" does not appear in the table, but only in the key. For several general chemical parameters, EPA methods exist and should be cited instead of "NA." Accuracy values for many of these parameters can also be determined and should be included. Target detection limits for all parameters should be set. The use of "Westinghouse" in all the columns for radionuclides is meaningless. Values for radionuclides must be determined prior to analysis of environmental samples.

Response:

Will add to this table.

3. Deficiency/Recommendation: Section 3.0, p. QAPP-9

Analytical procedures should be established prior to QAPP approval and not "After individual laboratory statements of work are negotiated and procedures are developed and approved."

Response:

The text states that the QAPP Table 1 will be updated based on any new information that may be laboratory dependent.

4. Deficiency/Recommendation: Section 4.1.1, p. QAPP-10

All procedures should be reviewed by regulatory personnel. A specific request to the "Technical Lead" to review procedures should not be required.

Response:

Will delete the last part of this sentence.

5. Deficiency/Recommendation: Section 4.2.2, p. QAPP-11

Westinghouse Hanford surface water sampling methods "must be" instead of "should be" developed prior to beginning the field investigation.

Response:

Accept.

6. Deficiency/Recommendation: Table QAPP-2, p. QAPP-12

Inappropriate or incomplete references have been given for several methods. See comment QA-4.

Response:

Accept.

7. Deficiency/Recommendation: Section 6.0, p. QAPP-18

Level IV calibration procedures are not addressed. Reference CLP SOW calibration procedures for Level IV methods.

Response:

Accept.

8. Deficiency/Recommendation: Section 8.0, p. QAPP-19

All supporting documentation should be included in all data packages.

Response:

Disagree. Level I, II, and III data should be qualified but not necessarily accompanied by all supporting data.

9. Deficiency/Recommendation: Section 8.2, p. QAPP-20

The percentage of data to be validated has been omitted. Include what percent of the data and which data types will be validated.

Response:

All Level IV data will likely be validated. Other Levels and types of

data may be evaluated and validated or qualified on a case by case basis. It is certainly in the best interest of all parties to qualify as much of the data as possible, and no data will be used for decision making purposes without some pedigree. However, the absolute percentage of validated data necessary may vary depending on the needs and goals of a particular aspect of a project.

10. Deficiency/Recommendation: Section 8.2.2, p. QAPP-20

Validation of Level IV data is not discussed. Validation procedures for Level IV data are suggested for conducting validation on Level III data (EPA, 1988a and 1988b). Clarify intent and identify what level the resulting validated data is supposed to be.

Response:

No established validation criteria have been developed specifically for SW 846 analyses (Level III), so CLP (Level IV) validation criteria are commonly used. This, however, does not result in Level IV data. As the title of the Section indicates, the discussion concerns Level III data.

11. Deficiency/Recommendation: Section 9.0, p. QAPP-22 through QAPP-24

Only Level III and V analyses are addressed. Level IV data should be included. Use of SW-846 (EPA, 1986) will result in Level III data. The use of these methods should be re-evaluated. SW-846 (EPA, 1986) methods are not cited in Tables QAPP-1 and QAPP-2.

The percentage of split samples and blind samples should be given or the criteria to be used by the Technical Lead to direct the taking of such samples should be given. Internal QC checks for Level IV laboratory analyses have been omitted. This information should be included.

Change "greater" to "less" in the last sentence of both the matrix spiked samples and QC reference sample bullets.

Response:

This Section refers primarily to field checks on laboratory and sampling quality control. These are defined in SW 846 (EPA 1986), to a limited extent in the CLP validation guidelines (EPA, 1988a and 1988b), and other guidance documents (e.g., EPA 1987). Use of these quality control checks will not result in Level III data. However, it is agreed that samples sent for Level IV analyses should use the same quality control criteria.

Percentages or minimum numbers are specified. The numerous internal laboratory QC checks for Level IV data will be included by reference.

The word "greater" should remain as this will result in better QC

control.

12. Deficiency/Recommendation: Section 12.0, p. QAPP-26

It is stated that the laboratory will validate data. State whether 100% of the data will be validated and what criteria will be used by the laboratory.

Response:

Section 12.0 does not state that data will be validated by the laboratory, only that the laboratory will compile the data. See Section 8.2

13. Deficiency/Recommendation: References, p. QAPP-28

"EPA, 1988c" should be a more recent version, "EPA, 1989."

Response:

Accept.

TECHNICAL REVIEW COMMENTS
100-KR-4 OPERABLE UNIT
RI/FS WORK PLAN, ATTACHMENT 2
HEALTH AND SAFETY PLAN

1. **Deficiency:** Section 1.3, p. HSP-4

This section does not mention record keeping, which is an important part of medical surveillance.

Recommendation:

Insert a brief statement about standard record keeping procedures. Explain where the records will be kept, who has access to them, and how long they will be kept.

Response:

Accept.

2. **Deficiency:** Table HSP-2, p. HSP-19

The label of the middle column ("Chemical") gives the impression that these chemicals are either of primary concern, or are the only chemicals known at this time.

Recommendation:

If these are indeed the chemicals of primary concern, the column should be retitled to reflect that. If these are the only chemicals known at this time, the column should be retitled to reflect that.

Response:

Accept.

3. **Deficiency/Recommendation:** Section 5.0, p. HSP-23, first sentence on page

The goal that "the Site Safety Officer shall be present at all times during work activities" is good, but probably unrealistic. Include a statement about who will assume responsibilities when the Site Safety Officer is sick, away on vacation, or otherwise unavailable.

Response:

Accept.

4. **Deficiency:** Section 5.0, HSP-23, last paragraph

The acronym "HEHF" is undefined.

Recommendation:

Define HEHF.

Response:

The acronym was defined upon first use (see Section 1.3).

5. Deficiency/Recommendation: Section 6.2, HSP-27, mid-page

According to the text, under heat stress, the employee "is to immediately leave the work area, rest, cool off, and drink plenty of cool water." Because this is a life-threatening situation, the employee should also be under escort and observation for a period of time.

Response:

The paragraph will be modified to include this information in the PJSP (now called HWOP).

TECHNICAL REVIEW COMMENTS
100-KR-4 OPERABLE UNIT
RI/FS WORK PLAN ATTACHMENT 4
DATA MANAGEMENT PLAN

1. Deficiency: Section 3.2.5, p. DMP-25

The text refers to "EII 2.1" and "EII 2.2," without providing a reference.

Recommendation:

Provide reference.

Response:

Accept.

2. Deficiency: Section 3.3.6, p. DMP-27

The text refers to "OSM" without clarification.

Recommendation:

Define OSM.

Response:

Accept.

3. Deficiency: Section 4.0, p. DMP-27

The text refers to "EIMP" in first line, without first defining the acronym.

Recommendation:

Insert "Environmental Information Management Plan" before EIMP is first used.

Response:

Accept.

4. Deficiency: Section 5.1, p. DMP-28

The text refers to "HEIS" in first line, without first defining the acronym.

Recommendation:

Insert "Hanford Environmental Information System" before "HEIS" is first used.

Response:

Accept.

5. Deficiency/Recommendation: Figures DMP-1 and DMP-2, p. DMP 23 and DMP-30

The third box down on the left side refers to a "RFT/CMS Technical Coordinator". Should it read "RI/FS Technical Coordinator"?

Response:

Yes, will correct.

9011335163

MISCELLANEOUS COMMENTS

1. Acronym List, p. iii

In line 6, "ASME" should be substituted for "ATSM"

In line 16, "laboratory" should be substituted for "liability"

Response:

Accept.

2. Acronym List, p. iv

In line 3, "EDMC" should be substituted for "EDMS"

In line 4, "EII" should be substituted for "EEI"

In line 13, "Field" should be substituted for "Feasibility"

In line 14, "System" should be substituted for "Plan"

Response:

Accept.

3. Acronym List, p. v

In line 26, "pollutant" should be substituted for "pollution"

Response:

Accept.

4. Deficiency/Recommendation: Table of Contents, p. WP-vii through WP-ix

In "Table 3.2 Summary of Radionuclide Inventories in the 100-K Retention Basins in 1978," 1976 should be substituted for 1978.

Most of the table titles in the "TABLES" do not match the titles of the tables in the text.

Response:

Accept.

5. Figure 2-17 and Table 2-8, p. WP 2-69 and WP 2-79: Dates on figure disagree with dates in table; K-20 2/16/89 or 2/17/89, 72-73 6/9/89 or 6/10/89?

Response:

Accept.

6. Table 4-1, p. WP 4-8: Separate "Hydraulic gradient between aquifers interaction with Columbia River" into two separate data types.

Response:

Accept.

7. Section 4.3.3.5, p. WP 4-21: The geologic and geophysical logs will presumably be used for geologic and ground water interpretation. Include these work items under both categories.

Response:

Accept.

8. Figure 5-1, p. WP 5-7: Legend indicates well 22A; could not find on map.

Response:

Accept.

9. Figure 5-1, p. WP 5-7: Should K21A be K21?

Response:

Accept.

10. Figure 5-1, p. WP 5-7: Two different wells are labeled K20B.

Response:

Accept.

11. Section 5.2.4.2.2.3, p. WP 5-13 should be Section 5.2.4.2.3.

Response:

Accept.

12. Section 5.2.6.2.2.2, p. WP 5-31: Typo, hydrdogeologic

Response:

Accept.

13. Section 4.1.1, p. WP FSP-6: In the last sentence it appears that the word "be" was left out. ["Emphasis will (be) placed...].

Response:

Accept.

14. Section 5.0, p. FSP-9: It appears that "I" was left out between "Phase" and "RI".

Response:

Accept.

15. Section 5.1.1.1, p. FSP-13: Typo, remove "the" in "...additional borings the may be sampled."

Response:

Accept.

16. Section 8.0, p. WP 8-1: Typo?, Brown, D.J., 1989, should be 1962.

Response:

Accept.

17. Section 8.0, p. WP 8-3: Typo?, ONL-5397, should be PNL 5397.

Response:

Accept.

References

EPA*, 1989a. U.S. EPA Contract Laboratory Program, Statement of Work for Organic Analysis, 1989.

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EPA, 1986. EPA-SW-846, Test Methods for Evaluating Solid Waste, third edition, November 1986.

EPA, 1983. Interim Guidelines and Specifications for Preparing Quality Assurance Project Plans, Office of Monitoring Systems and Quality Assurance, Office of Research and Development, EPA-600/4-83-004.

Long, E.R. and L.G. Morgan 1990. The Potential For Biological Effects of Sediment-Sorbed Contaminants Tested In The National Status And Trends Program. NOAA Technical Memorandum NOS OMA 52. 175 pages plus Appendices.

*U.S. Environmental Protection Agency

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Author

Addressee

Correspondence No.

S. H. Wisness, DOE-RL

P. T. Day, EPA

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